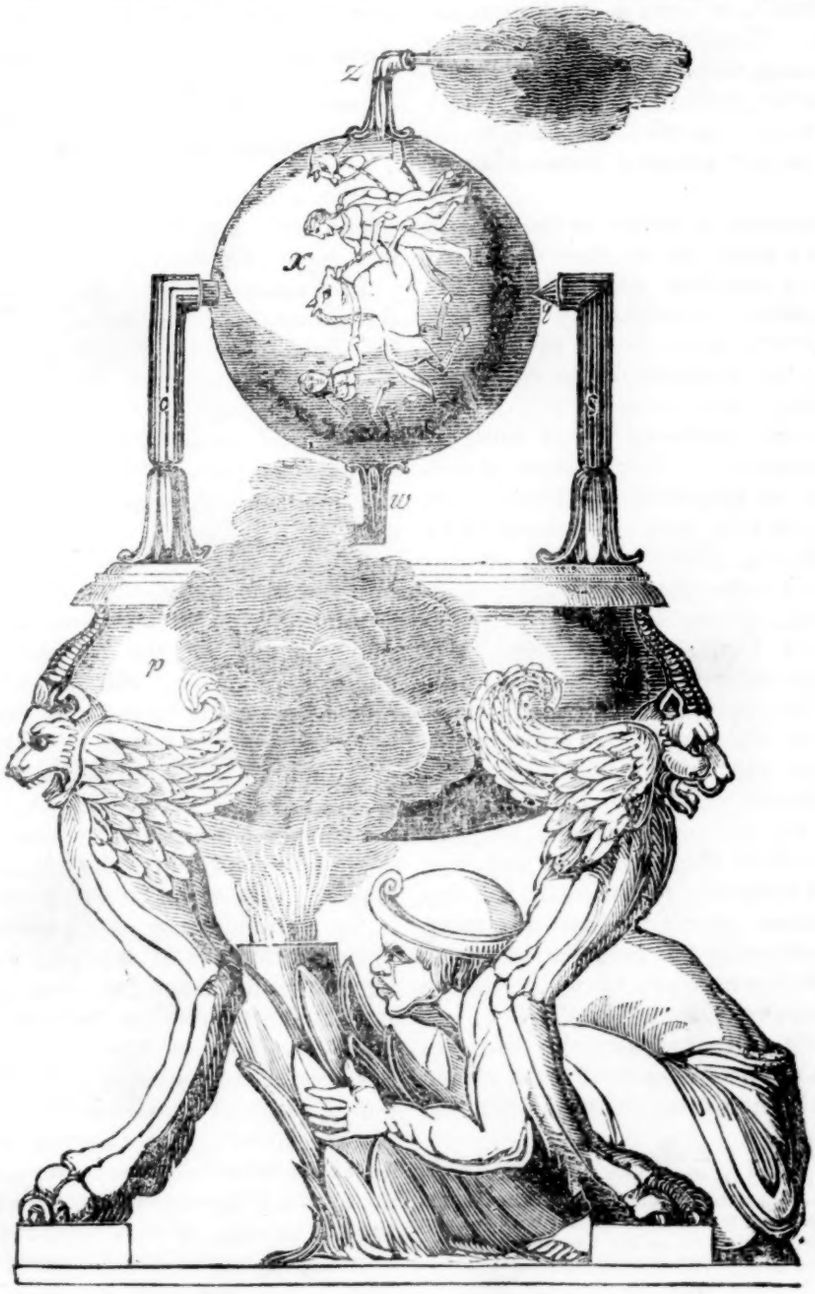
MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME II.] SEPTEMBER, 1833. [NUMBER 3.

"Th' invention all admired: and each how he
To be th' inventor missed, so easy it seemed
Once found, which yet unfound, most would have thought
Impossible."—MILTON.



ANCIENT GREEK STEAM ENGINE.—This machine is constructed on a similar principle to that described at page 58, in our last number: a globe moved on a pivot, by means of steam conducted into it from a boiling caldron.

The caldron or heated vase, *p*, is to be closely covered with a lid; into which a pipe, *o*, is inserted at one side of its circumference. This pipe, after rising vertically for a short distance, is bent at right angles. On its horizontal end is placed a small globe, *x*, kept in its position by a pipe, *s*, also bent at right angles and fixed to the lid opposite to *o*, but terminating in a pivot, *q*, on which the little globe revolves. This globe is furnished with two small pipes, *z*, *w*, bent at their extremities and open. The steam from the boiling water in *p*, rising through the pipe *o*, is admitted at *s* into the globe; and issuing through the bent tubes *z*, *w*, causes the sphere to revolve as if it were "actuated from within by a spirit."*

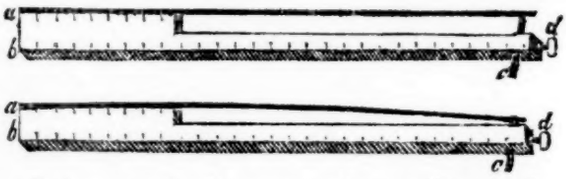
That so ingenious a people as the Greeks should not have been led, by those direct experiments, to a practical application of the agent so exquisitely moulded by Hero into a mechanic power, may, in all probability, be ascribed to the operation of the same causes as those which have thrown a veil of deep and impenetrable obscurity on so many of the arts of antiquity. "The ancient philosophers," says an excellent mechanic, "esteemed it an essential part of learning to be able to conceal their knowledge from the uninitiated; and a consequence of their opinion, that its dignity was lessened by its being shared with common minds, was their considering the introduction of mechanical subjects into the regions of philosophy a degradation of its noble profession; insomuch, that those very authors among them, who were most eminent for their inventions, and were willing, by their own practice, to manifest unto the world these artificial wonders, were, notwithstanding, so infected by this blind superstition, as not to leave any thing in writing concerning the grounds and manners of these operations; by which means it is that posterity hath unhappily lost, not only the benefit of these particular discoveries, but also the proficiency of these arts in general. For when once learned men did forbid the reducing them to vulgar use and vulgar experiment, others did thereupon refuse those studies as being but empty and idle speculations; and the divine Plato would rather choose to deprive mankind of those useful and excellent inventions, than expose the profession of the ignorant vulgar."—[Stuart.]

* The *Spiritalia* was first edited by Commandine, in 1571. It is also printed in the splendid folio collection of the works of the *Ancient Mathematicians*, published at Paris in 1693. The Greek text is accompanied with a Latin translation. The descriptions of the two machines we have described are in pege 202 of that edition.

Scale for Graduating Columns. By (?).

To the Editor of the Mechanics' Magazine.

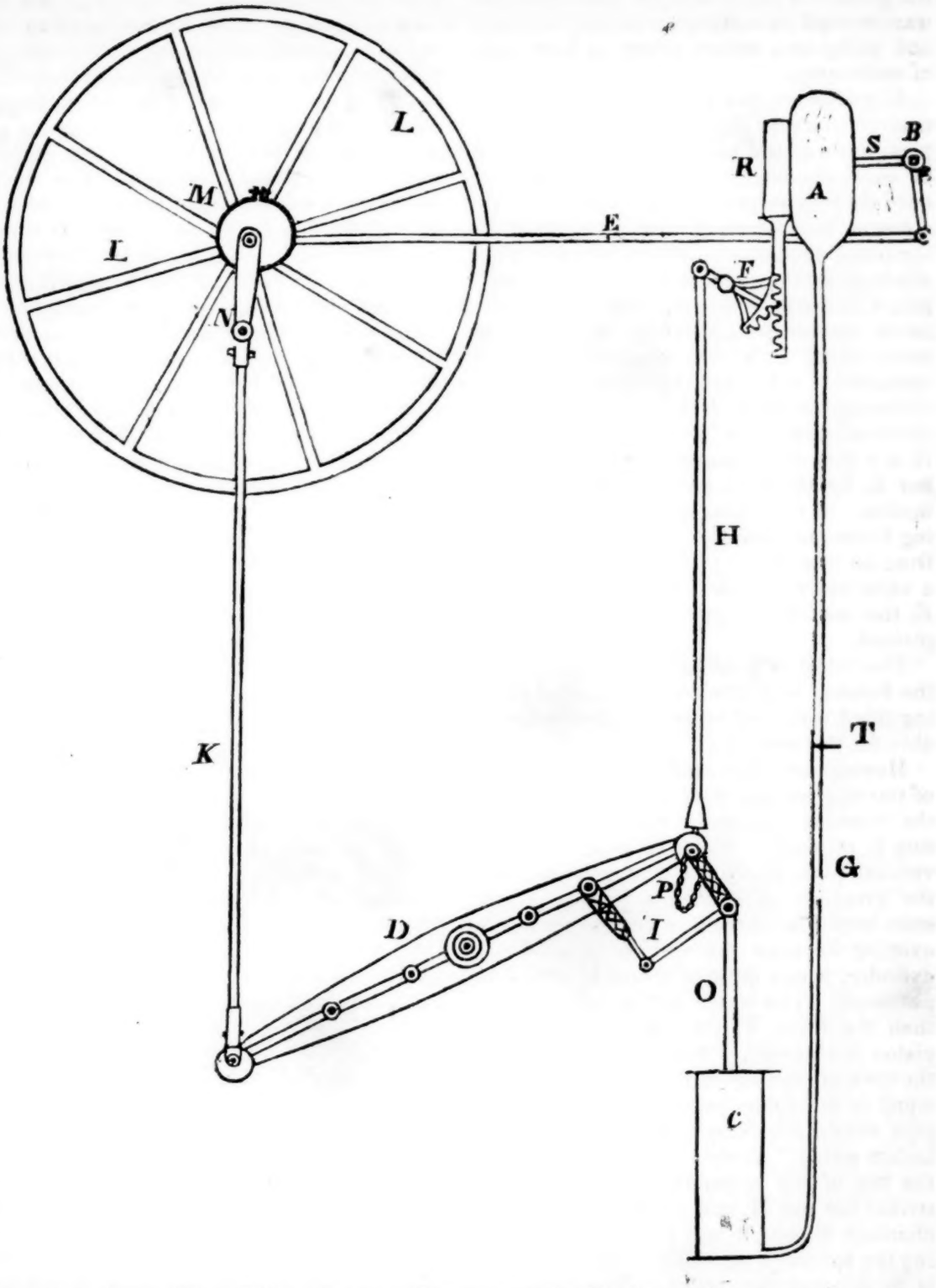
SIR,—If the instrument which I describe below is not already known and in use, (which I am not aware of,) an acquaintance with it may be of advantage to some of your subscribers.



It is a scale for graduating columns, by which they are drawn with more accuracy and expedition than by the usual method.

It is composed of a flexible arm, *a*, and a fixed one, *b*. *a* is united to *b* at one end for about one-third the length of the instrument, and connected with it at the other by a small segment, *c*, which is secured at the desired point by a screw, *d*, in the end of the fixed arm. The screw is thus placed to allow the instrument to be used on either side. (?).

SKIN AND STOMACH.—Let these two important organs be attended to in a proper manner, and all the diseases of summer, cholera inclusive, will be avoided. The kind of attention to the skin consists in daily friction with a coarse towel or flesh brush—the tepid or warm bath twice, or, at least, once a week; or, in lieu of this, daily sponging the surface with salt and water, with the chill taken off it, and then rubbing with a dry coarse towel. The stomach will have justice done it by an avoidance of all alcoholic drinks; the moderate use of tea and coffee, if such be habitually taken; a due proportion of well boiled vegetables, with meat, roasted or boiled; and on occasions, in sanguinary temperaments in a feverish habit of body, a moderate share of ripe cooked fruits, to the exclusion, however, of cherries and plums. In all cases where disease is present in a place, no kind of fruit, nor any new or unaccustomed article of diet whatever, should be taken *in the evening*.—[Journal of Health.]



Suggestion for a New Motive Power. By G. N. To the Editor of the Mechanics' Magazine.

Sir,—As it is a professed object of your valuable Magazine to disseminate the knowledge of new discoveries, inventions, and improvements, I submit to your consideration the following description of a Hydro-pneumatic Engine, which, to me, is entirely original. In so doing I am not about to attribute to myself the discovery of any new principle, but think I can, with perfect confidence, lay claim to any advantages that may arise from a successful application of long known principles. It may not be improper here to remark, that, although I have

not given it a *fair* trial, yet the experiment was enough to convince me of its success and utility as a motive power to most kinds of machinery.

C is a strong cast iron cylinder, similar to that of a steam engine on the atmospheric plan, open at the top. G is a vertical pipe of small diameter, whose height cannot exceed 32 feet, joined to the cylinder C. O is a piston rod, attached to a piston packed in the usual manner. D is a working beam, attached by the parallel motion to the piston rod, O, at one extremity, and at the other to the shackle bar, K, which works the balance wheel L, by the crank N. M is an eccentric. E is a connecting rod, worked by the eccentric M. A is an air-tight sphere, attached to the top of the vertical pipe G. H is a rod, which moves a slide in the chamber R, by the cogs at F. I is the parallel motion. P is a cham connecting the working beam and rod H. S is a pipe leading from an iron retort to the sphere A. B is a valve moved by the eccentric M, and rod E, the use of which will be hereafter explained.

The retort is furnished with a furnace for the forming of carbureted hydrogen gas, being filled with coal or other substances suitable for the purpose.

Having now explained the different parts of this engine, and their uses, I come now to the "modus operandi," the manner of setting it to work. Water is poured into the vertical pipe, G, till it elevates the piston on the principle of Bramah's Press. I must state here that there is a certain proportion existing between the vertical pipe, G, and cylinder, which must be found by actual experiment. The water should not be higher than the mark T, for instance, when the piston is elevated. Now, it is evident that the area of pipe above the mark T should be equal to the space below the piston, and the pipe should not exceed 32 feet in height, as before stated. As soon as the piston reaches the top of the cylinder, the working beam strikes the rod H, and shuts the slide in the chamber R, which was before open, rendering the sphere A air-tight. The next object is to depress the piston. The retort and pipe S being now filled with gas, an assistant fires the gas, and with a winch, for the purpose, turns the jet into the sphere A. The burning of the gas forms a vacuum: the water in the tube is raised, and the piston depressed. When the piston reaches the bottom of the cylinder, the chain P opens the valve at R, destroys the vacuum, and the water returning to its former position elevates the piston, strikes the rod, closes the slide. At the same instant the eccentric M throws in the jet of gas, a vacuum is re-produced. The machinery for throwing the gas in and out is very imperfect, and perhaps may not be clearly understood. The machinery here used is similar to that of Brown's Pneumatic Engine. I must refer the reader to a description of this engine in Nicholson's Operative Mechanic, where it is clearly explained. This engine might, perhaps, be improved by placing a cylinder at each extremity of the working beam. I think it may also be worked by mercury. But the engine must be much smaller in size; as mercury is twelve times heavier than water, the engine should be of such dimensions that its vertical pipe should not exceed 32 inches.

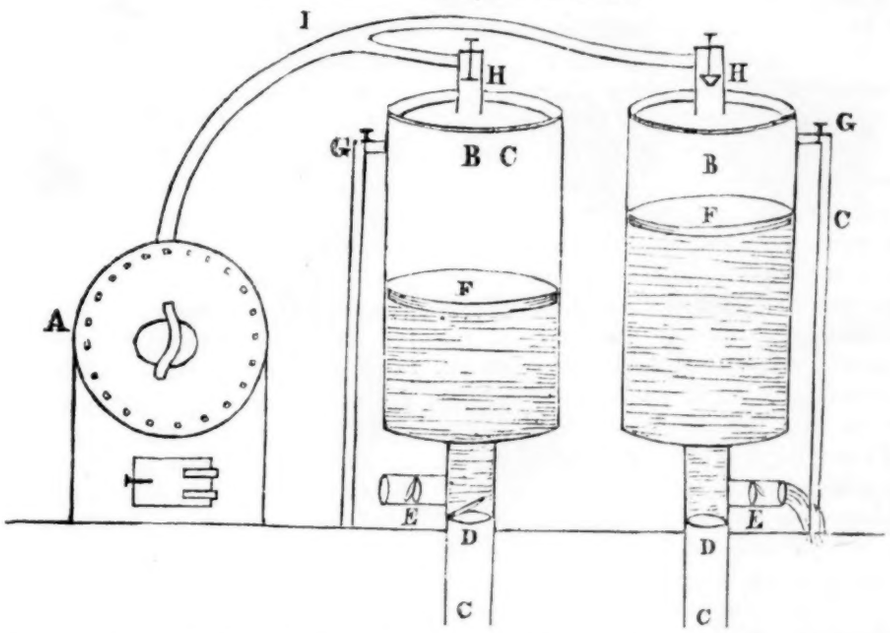
I shall be glad to see any remarks your readers may see fit to publish respecting the above. Yours, &c. G. N.

Effect of the Scholastic System of Scotland.—The following eloquent observations are from the pen of the Rev. Dr. Chalmers, and they are as remarkable for soundness of thinking, as for splendor of style:

"It is not scholarship alone, but scholarship impregnated with religion, that tells on the great mass of society. We have no faith in the efficacy of mechanics' institutes, or even of primary or elementary schools, for building up a virtuous and well conditioned people, so long as they stand dissevered from the lessons of christian piety. There is a charm ascribed to the scholastic system of Scotland; and the sanguine imagination is, that by importing its machinery into England and Ireland, it will work the same marvellous transformation there, on the character of their people, that was experienced among ourselves. But it is forgotten, that a warm and earnest christianity was the animating spirit of all our peculiar institutions, for generations after they were framed; and that, wanting this, they can no more perform the function of moralizing the people, than skeletons can perform the functions, or put forth the faculties, of living men. The scholastic is incorporated with the ecclesiastical system of Scotland; and that, not for the purpose of intolerance and exclusion, but for the purpose of sanctifying education, and plying the boyhood of our land with the lessons of the bible. The scholarship of mere letters

might, to a certain extent, have diffused intelligence amongst their people; but it is mainly to the presence of religious ingredients, that the moral greatness of our peasantry is owing."

Most Important, if true.—A discovery of considerable importance, as connected with the production of steam, has just been made by the superintendant of one of the gas establishments in the metropolis. He has ascertained that an excellent fuel may be provided in coke, gas tar, and water, applied in particular proportions; and as the weight of this fuel is little more than one-third of that of the quantity of coals requisite to produce the same result, it will no longer be difficult to establish communication by steam with India and other distant parts of the world, the great, and, indeed, hitherto insuperable objection, (the weight and bulk of the fuel,) being now removed. Colonel Torrens, (the member for Bolton,) some time since, we understand, took out a patent for the discovery of a locomotive power, still more astonishing than this, for his principle was a power derived from an article requiring so little bulk that a quart of the liquid would produce sufficient for the impulsion of a ship or carriage over fifty miles. The subtlety of this article, however, is said to be such that it cannot be confined within any known metal, and, therefore, the discovery is without beneficial result. There is no objection of this kind to the discovery above named.—[London Court Journal.]



Steam Pump.—A, the boiler; B C and B, two condensers; C C, large tubes (two), through which the water is drawn into the condensers; D D, valves to prevent the water from returning; E E, valves, which act alternately, to prevent the air from passing in, and allow the water to pass out; F F, two wooden floats, that remain on the surface of the water, to prevent the steam acting on the water; G G, two small pipes, through which cold water passes to condense the steam; H H, steam valves, to admit and shut off the steam; I, steam pipe.

This drawing represents a newly invented machine, which we have witnessed in operation on a small scale. The object of it is to raise water, by forming a vacuum in the cylinders, by admitting a quantity of steam sufficient to supply the place of atmosphere (or rather of atmospheric pressure), and then condensing, which causes the cylinder to fill with water, and is discharged immediately when full; it is then filled with steam again, and the operation repeated, so that a continual water power is thus produced on an economical plan, both as regards the structure of the machinery and the saving in water. We think it important, and should be highly gratified to receive the opinions of any of our scientific correspondents on the subject.

The Mechanics of Baltimore, Md., and Paterson, N. J., have held meetings for the purpose of returning some of their body to the State Legislature. We shall refer to this more particularly in our next.

ROTARY PUMP.—Messrs. Hale, Crane & Co. of this city, have obtained a patent for, and established a manufactory of, a new rotary pump, which promises to be a decided and valuable improvement. Two wheels are inclosed in a casing which corresponds with them in size, and which fits closely upon their sides. One of the wheels has, on its periphery, floats or wings, three in number, at equal distances apart—somewhat like cogs; the other wheel has cavities, into which the cogs or floats may fall; both wheels being so placed in their casing as to revolve together, and their peripheries forming a water joint. Through the ends or heads of the casing pass the shafts, which support and turn the wheels. There are two apertures in the casing, through one of which the water is drawn up by the suction produced by the motion of the floats as they recede from the wheel containing the cavities, and through the other the water is discharged, by the approach of the floats towards it. The pump may be put in motion by the hand or other power. One 14 inches in diameter, with the application of the power of two men, will raise and discharge 180 gallons per minute. A pump of this size is already in successful operation at the Simsbury mines in this state; and orders for others have been received from several States in the Union.—[N. Eng. W. Review.]

MR. TREVITHICK.—We regret to learn that this distinguished engineer, who may justly be regarded as the father of steam locomotion in England, died on the 22d May at Dartford, in Kent, in his 67th year.

WESTERMAN'S MACHINE FOR SPINNING HEMP.—The annexed drawing represents an end view of this *labor saving machine*; of its utility there cannot be a doubt. It has been in practical operation for some time past. We have seen rope-yarn made from it, and have no hesitation in saying that it is much superior to any we have ever seen produced by hand-spinning. To show the advantages it offers to those capitalists who will embrace an economical method of manufacturing rope, we cannot do better than insert the annexed letter from the patentee.

References—C, the comb plate; H, the top or pressure roller; K, the flyer; L, the spindle; *m*, the mangle wheel, which lifts the bobbin up and down; *n*, the lifting plate; *o*, the frame that supports the lifting motion; *p*, the pulley that drives the spindle; *q*, the driving pulleys; *r*, the bobbin; S S, boxes. —The process is begun at S S; is carried over the combs C, which cleanses and dresses the hemp, and lays the fibres in straight lines through the upper roller H, and under roller H, and afterwards through the rubber immediately under the roller H, as shown in the engraving, through the top of the spindle, where an aperture is made to receive it, and then through the flyer and round the bobbin. —[ED. M. M.]

To the Editor of the Mechanics' Magazine:

SIR,—I take the liberty of laying before you an exact detail of what my machines are capable of performing in ten hours' work, for your immediate information, and for that of your numerous readers:

Machinery to spin one ton of rope-yarns per day—Four machines called breakers, $2,000; 6 machines called finishers, $2,400; two spinning frames of 16 threads, $1,600; three doubling frames, $400; total, $6,400.

Manual labor per day—Two men to prepare the material, $2.50; ten boys or girls as tenders, $5.00; total, $7.50.

A shop 50 feet by 25 will be sufficient for the above machinery, placed at the head of a railroad, which will be the most advantageous, as the yarns will be laid in the walk the same as hand-spun yarns. The rent of such a room will vary according to situation, say, however, one dollar per day.

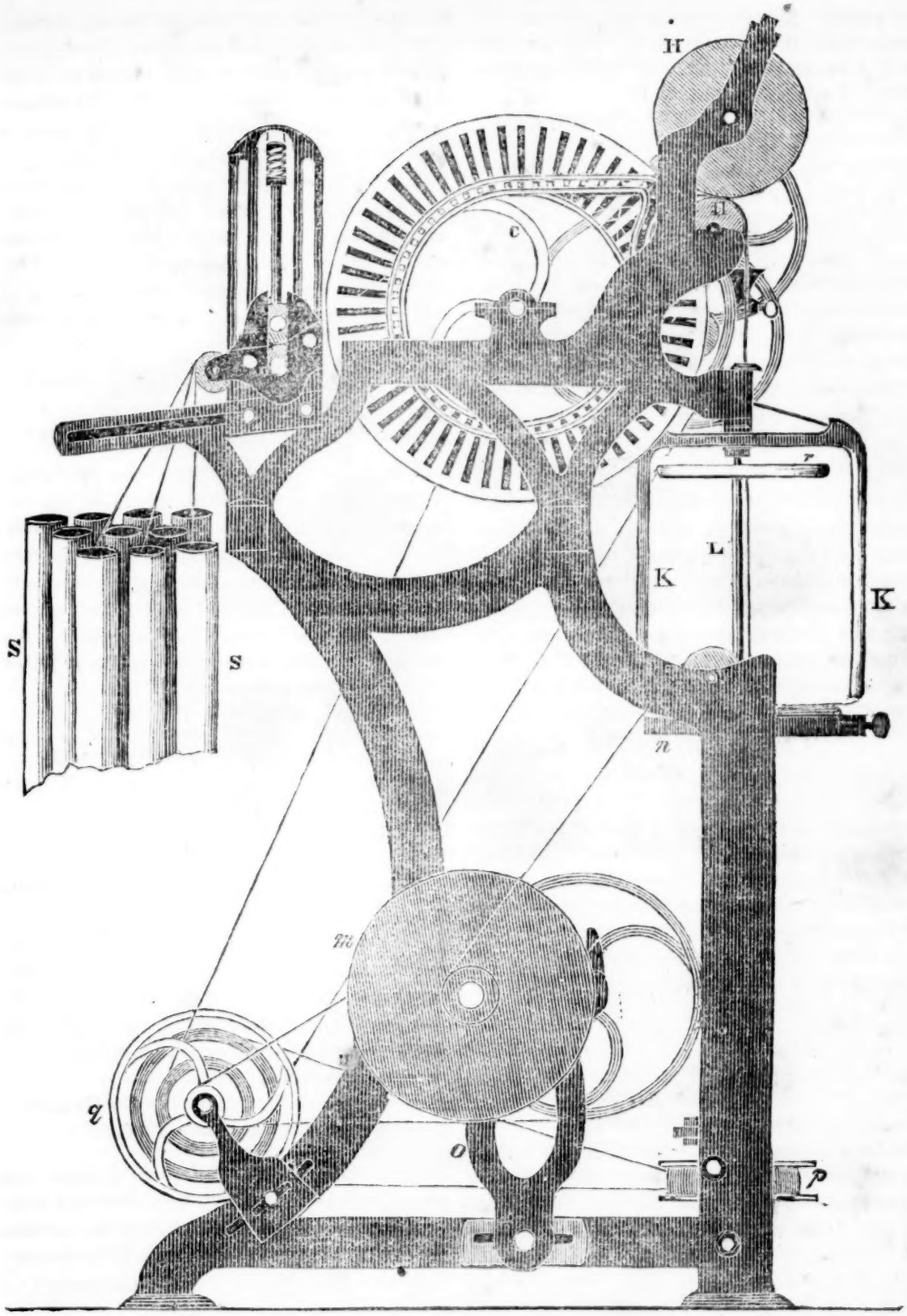
A four-horse power, steam or water, will be sufficient. The price of this will also vary according to situation, whether steam or water; however, say steam, which, including fireman, oil, coals, &c. will, I presume, be five dollars. When water-power can be had, it will be much cheaper. The cost price of such an engine, including mill gear, &c. &c. will be at *high rate*, $1,800.

Sundry other articles—Straps, tin boxes, and other unforeseen expenses, say $800.

Total expenses—Machinery, $6,400; steam engine, $1,800; sundry expenses, $800; total, $9,000,—which, at 6 per cent. per annum, is equal to $1.50 per day.

Daily expenses—Hand labor, $7.50; rent, $1.00; interest of $9,000, at 6 per cent. per day, $1.50; oil for machinery, 25 cts.; repairs, 75 cts.; expenses of engine, $5.00; insurance on $10,000, at 3 per cent. per day, $1.00: making the total cost of *one ton* $17.

The above prices are rated according to New-York rates. In other places the expenses will not be so great; situation makes all the difference. I do not pretend to know the true price of hand-spinning, as none of



the workmen will inform me; however, upon the lowest scale, there is 40 per cent. in favor of machine-spinning on the above calculation. Where water power and manual labor is cheap, yarns may be manufactured for something near half price. From all I have been able to learn, the waste in hand-spinning is from 8 to 10 per cent. which added to the price of hand-spinning makes a very considerable augmentation in the price

of yarns. In my plan I can *warrant* not more than 3 per cent. *loss*. My machine will, I am satisfied, bear a strict examination. I am, sir, yours, truly,

J. Westerman.

On the Construction of Curves for Arches.

By J. S. Van De Graaff. To the Editor of the American Railroad Journal.

Sir,—An article in the 34th number of the American Railroad Journal,* on the construction of curves for arches, contains a method of constructing an elliptical segment, which will not vary essentially from the true curve of equilibrium with a horizontal roadway. This subject, perhaps, requires a more full investigation; for notwithstanding the curve of equilibrium, in the case proposed, is well known to the scientific engineer, yet that curve is seldom employed in practice, even in the arches of large culverts, which support a heavy pressure of embankments, *in consequence of the difficulty of construction;* and I know of no author who has given so accurate an approximation of the true curve, as that by means of an elliptical segment, which may be easily constructed.

I am, therefore, induced, in consideration of the practical utility of this subject, to present to you the following investigation for the mathematical readers of your Journal, with a hope that it will, if possible, elicit from them a convenient and more perfect arch than the segment here proposed.

It is a fact easily demonstrated, that *no curve of the parabolic kind* is well suited for the arch of a large culvert, which is to sustain a heavy pressure with a horizontal roadway. For the general equation of such curves being $x \propto y^m$, they are equilibrated when the pressure $\propto y^{m-2}$: and, therefore, when $m < 2$, the curve is not proper for sustaining much weight near the springing points; and when $m > 2$, it will not be well adapted for supporting much pressure at the crown. And from a similar investigation, it will appear that the hyperbolic curve is also liable to the same objection; and that the segment of an ellipsis may be made to approach very nearly to the curve of equilibrium in the case proposed. It is true, as mathematicians have demonstrated, that a conic section may be made to pass through five given points; and when those points are taken in the flanks, springing points, and crown, of the equilibrated curve, it is evident that either the ellipse or hyperbola may be made to meet the curve in all those points. Nevertheless, the hyperbola would be very injudiciously used in such a case, as will readily appear from the above.

Let p denote the rise, q the half span, and h the thickness at the crown, including the thickness of the ring of the arch and the matter above, reduced to a homogeneous mass. The following is then the well known equation of the curve of equilibrium with a horizontal roadway:

$$y = q \times \frac{Log.\left\{x+h+\overline{x^2+2hx}\right|^{\frac{1}{2}}\left.\right\} - Log.\ h}{Log.\left\{p+h+\overline{p^2+2hp}\right|^{\frac{1}{2}}\left.\right\} - Log.\ h}.$$

Now, in producing a coincidence of curves, corresponding to any given values of the coordinates x y, it will be found that the equilibrium will be most complete when $x = \frac{2}{3}p$ very nearly; in which case, taking A to represent the logarithmic part of the above equation, we have $y^2 = q^2 \times A^2$; and, therefore, when a denotes the semi-transverse axis of the required ellipse, we have by con. sec.,

$$a^2 - \overline{a-p}^2 : a^2 - \overline{a-\frac{2p}{5}}^2 :: q^2 : q^2 \times A^2 ;$$

which produces the following formula,

$$a = p \times \frac{25A^2 - 4}{50A^2 - 20}.$$

From this formula the transverse axis of the required ellipse becomes known, and the conjugate may then be had without difficulty. It will be found that this value of the semi-transverse axis agrees with that given in the 34th number of your Journal, and which was obtained upon very different principles.

Very respectfully, yours, &c.

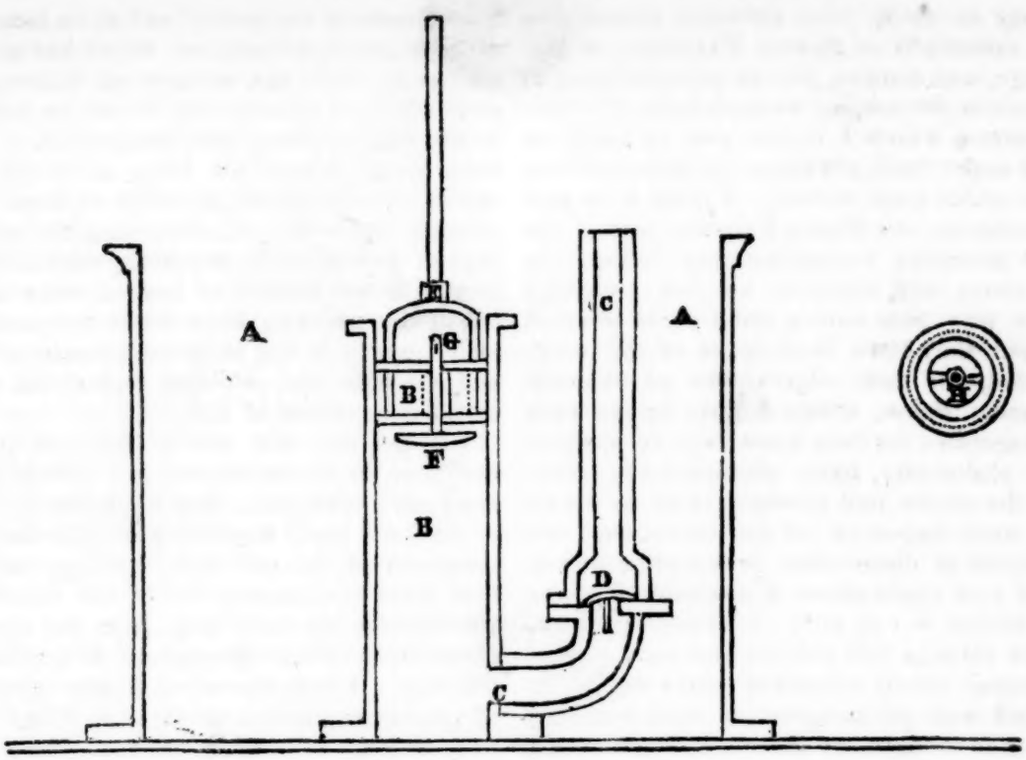
J. S. Van De Graaff.

Lexington, Ky., September, 1833.

Note.—The formula referred to above (as given in the 34th number of the Railroad Journal,) for determining the value of the *vertical axis* of the required ellipse, was by some inadvertence written wrongly in the manuscript. It should have been the following:

$$a = \tfrac{1}{2}p \times \frac{\left\{\frac{c'.\overline{2r+p}+2ch}{2c'r+2ch}\right\}^{\frac{1}{3}}}{\left\{\frac{c'.\overline{2r+p}+2ch}{2c'r+2ch}\right\}^{\frac{1}{3}} - 1}.$$

* See Mechanics' Magazine, for August, page 62.



Hot Water Pump. By G. M. [From the London Mechanics' Magazine.]

Sir,—I beg the insertion of the annexed plan of a hot water pump:

A A is a square or oblong cistern of cast iron, or any other suitable metal, to contain the pump, but must be deeper than the height of the pump, and be continually kept full of water. B is the barrel of the pump, (I shall not say any thing about the proportions of it,) truly bored, and is to be fixed to the bottom of the cistern. C C is the outlet for the water contained in the pump to the boiler. D is a valve fixed in the elbow of the pipe C C, to stop the water from coming back to the barrel again by the pressure of the steam on it from the boiler. E is a valve or bucket, such as used in other pumps, and to be packed with hemp, or any other suitable packing, in the groove H, made to receive it, with the exception of the spindle valve, F, inverted, and is kept from falling through by a pin placed in the hole G, made in the spindle to receive it. H is a section of the valve E, with a bridge across it to receive the spindle of the valve F.

The action of the pump is as follows: The cistern A A, being full of water, fills the barrel B by running over the top of it. The bucket E, and valve F, being at the top of the barrel B, and ready to be forced down the engine, the water which is between the valve F, and the bottom of the pump, is forced by the action of the bucket E, descending, and valve F closing, through the pipe C; while the valve D, immediately that the bucket has got to the end of its stroke, stops all return of water; then the bucket E is drawn up to the top of the pump, and the water, by its own gravity, fills the pump by the valve F descending as far as the pin; and so the process is repeated.

Your obedient servant, G. M.

P. S.—I am well aware that the pump has the pressure of the air to resist in its upward stroke; but considering the numerous stoppages and delays occasioned by the valves of the pumps now in use, and the uncertainty of their action, I think the pressure of the air in this but a minor consideration when compared with the other.

S. Fairman's Rotary Steam Engine, Machine for making Wrought Nails, &c. [Communicated for the American Railroad Journal.]

Lansingburgh, Aug. 15, 1833.

Dear Sir,—Having witnessed, with no small admiration, your untiring industry and zeal in helping forward to the most useful application the mental and physical resources of our country, and particularly in encouraging and bringing before the public the discoveries of mechanical genius, I take the

liberty to invite your attention to some of the inventions of SIMON FAIRMAN, of this village, and sending you an advertisement of a *machine for making wrought nails* of different sizes, which I desire you to insert in your paper and all other suitable publications under your control. I think it is safe to estimate our Simon Fairman one of the most inventive mechanics now living. In the above nail machine he has exceeded many who have before spent years to effect it; but they have been years of toil unrewarded, for their object was not accomplished. Some, whom I have known even distinguished for their knowledge of mechanical philosophy, have attempted and failed. But the above nail machine is by no means the most important of his inventions: the admirers of discoveries in scientific power, or of new applications of mechanical power, are invited to call at Mr. J. Humphrey's machine shop in this village, and view a *reciprocating rotary compound steam engine*, invented and put in operation in this village, which is thought, by those who have seen it and are good judges, destined to take the place of all steam locomotives on land now in use; also, at the same place, may be seen and purchased at a low price, the *reciprocating rotary compound pump*, a new invention, by the same man, and now in use, which offers to the public a convenience not liable to be "*out of order*" or "*frozen up*," to which mankind have heretofore been strangers. Also, a *fluting machine* has been invented by said Fairman, which will greatly abridge the manual labor employed in preparing an important part of the machinery used in cotton factories. This last machine was long in successful and useful operation, but was destroyed in the late disastrous fire at Waterford.

Now, sir, it is an act of justice due to such inventive geniuses, who with bold and adventurous canvass dare to sail in unknown oceans, or with equally bold conceptions and courageous daring, venture beyond those bounds which have hitherto limited, circumscribed, confined, and hedged in, the operations of the faculties of other men, to bring them before the public, while living under the most favorable circumstances. It is a small reward for being made the subject of scepticism, criticism, and witticism, of those who, but for the manifestation of a bold and adventurous genius, might have been their friends and helpers.

It is a small compensation for taking the "heir loom of the poets," and all its inconveniences and mortifications, which has almost uniformly been the scourge of discoverers in the field of science and of art, as well as in the field of fancy and imagination. It is but a small reward for being made the victim of the deceptious promises of those who possess the means of alleviating the sufferings of genius, made to obtain without compensation the benefit of her superior skill, exertions, and sacrifices, while the possessor of genius is left to go supperless to bed, and his wife and children endure the want of the necessaries of life.

I do not say that this is the case of my neighbor, to whose history and circumstances I am a stranger. But if he has not had, or does not have something of this kind to complain of, he will enjoy a happy exemption from the common lot of his fellow-adventurers in the same ship, from the days of Copernicus or the Marquis of Worcester to this day. I will, therefore, as one advocate of genius neglected, thank you, friend Minor, to lend a helping hand, to bring into more general notice an inventive genius of no ordinary skill and talent, by inviting the wise and skilful to call at the above named place in this village, and view some of the productions of Fairman's inventive mind and skilful hand, which they will not fail to admire and approve, whatever they may think of their final results.

Yours, respectfully, E. F. W.

P. S.—As soon as possible you may expect a drawing of the steam engine and pump.

List of New English Patents. [From the Repertory of Patent Inventions.]

Archibald Douglass, of Manchester, in the county of Lancaster, manufacturer, for certain improvements on power looms, and the shuttles used therein—dated April 30, 1833.

Charles Collinge, of No. 22 Bridge Road, Lambeth, in the county of Surrey, engineer, for an improvement or improvements in the making or manufacture of axle-trees—dated May 2, 1833.

John Holmes, of Birmingham, in the county of Warwick, engineer, for an improvement in metallic shanks for buttons—dated May 4, 1833.

Thomas Spinney, of Cheltenham, in the county of Gloucester, gas engineer, of "a new combination of materials for the manufacture of crucibles, melting pots, and fire bricks"—dated May 11, 1833.

James Fraser, of Bevis Marks, Saint Mary Axe, in the city of London, engineer, for certain improvements in steam boilers, and in the arrangement of the machinery attached thereto, as applicable to land carriages—dated May 7, 1833.

Louis Paul Lefort, late of Grand Couroune, near Rouen, France, but now residing in Cornhill, in the city of London, merchant, for certain improvements in machinery or apparatus for making or manufacturing lace, commonly called bobbin net. Communicated by a foreigner—dated May 22, 1833.

James Noble, of Little Horton, in the parish of Bradford, in the West Riding of the county of York, worsted spinner, for a machine for combing wool and other fibrous materials—dated April 25, 1833.

Christopher Robinson, of Athlone, in the county of Roscommon, in Ireland, for certain new or improved machinery for transferring caloric from aeriaform or fluid bodies to other bodies of the like description, and applicable to other useful purposes—dated May 2, 1833.

Henry Jones and Thomas Jones, both of Marple, in the county of Chester, weavers, for a certain method of expanding or stretching cloth, and keeping it even during the process of weaving, and of preserving the selvages thereof—dated May 4, 1833.

William Norvell, of the town and county of Newcastle-upon-Tyne, engineer, for an improvement of the machinery now in use for making strands from the yarns, and laying ropes by such machinery, at one and the same time—dated May 7, 1833.

William Graham, jr., of the city of Glasgow, cotton spinner and power loom manufacturer, for a self-acting temple to be used in the operations of weaving by power or hand loom. Communicated by a foreigner —dated May 22, 1833.

On Road Making, with the Use of Timber.

By John S. Williams. To the Editor of the American Railroad Journal.

Dear Sir,—In the last number of your valuable Journal received here, I observe a communication from Mr. Jno. Hartman, of Virginia, in which he professes to be the "inventor of an improvement in road making, in the use of timber." Claiming myself the inventorship of that improvement, I think proper to address the public in general, and Mr. Hartman in particular, through the columns of your paper.

That improvement was invented by me previous to April, 1831, in which month I filed a description of it in the patent office. I reported it to the Cincinnati, Columbus, and Wooster Turnpike Company, Dec. 8, 1831, who ordered one thousand copies of the report printed, which was done. They petitioned the Legislature of Ohio for leave to construct their road upon that plan, as it was not recognized in their charter, which was granted by act of Legislature, dated Jan. 19, 1832, a copy of which act I send you. An account of the invention entered into many of the newspapers of the day. Nearly one thousand copies of my report, containing a copperplate engraving of the improvement, were distributed in every state in the Union. Notwithstanding all which, I do not charge Mr. Hartman with a surreptitious use of my discovery. "I [too] have secured a patent right for the use of it, which I will dispose of to companies or individuals upon good terms."

In order to show the public and Mr. Hartman that my patent covers the whole ground assumed in his communication, I will extract from my specification:

"———— Have invented a new and useful improvement in the construction of roads, whereby some of the advantages derived from railroads are extended to common carriages of burthen or pleasure that travel any road so improved. * * * I lay two continuous lines of timber, or other suitable material, lengthwise on said road, such a distance apart as to form tracks for the wheels of such vehicles as are in general use upon the road so improved. I furrow, gutter, or groove one of these tracks, in order to receive and guide the wheel or wheels of one side of the carriage passing thereon. Those grooves or gutters may be made in the timber or other material—*or they may be formed by attaching cheeks or sides to a plain surface.*

"———— These tracks may be bedded or laid in or upon stone, gravel, clay, or any material of which the surface of the road is formed, and the pieces of which they are constructed may be connected by dowels or clamps, or laid upon *transverse blocks, or cross-pieces, which may or may not extend from one to the other.*

"———— Where there is much travelling upon a road so improved, I lay two sets, or four continuous lines of tracks, one set for the going and one for the returning carriages. I am aware that some of the advantages of such a track road may be gained by laying timber as above, by fur-

rowing, guttering, or rebating both tracks, to guide the wheels, but I prefer to gutter or groove one only."

I believe that Mr. Hartman and the public will at once see that every principle contained in his communication is also in the above extracts. I will go further, and say that I not only invented the plan, but that I can prove that I invented it, in all its parts, more than two years ago, and would long ere this have put it to the test of experiment upon a large scale, had not untoward circumstances prevented it. The graduation and timber are nearly ready for eight miles of it, and in a few days will be in progress of laying.

I am by no means disposed to quarrel with Mr. Hartman, but shall continue to grant rights upon terms which shall satisfy the public that individual aggrandizement was no moving cause of my taking out a patent therefor, cautioning all concerned against acting under an inferior title.

Should Mr. Hartman not be convinced that I have a priority of right in this matter, or fail to convince me that he has, I shall propose to him a reference of the whole matter to men competent to decide between our claims, and that they meet in Washington City sometime during the next session of Congress.

As to my preference for grooving or guttering one track only, it originated in my knowing that a guide for the wheels of one side of a waggon or carriage will in all cases answer as well as a guide for the wheels of each side; besides which, there is a difference of about eight inches in the span of axles as constructed in different states and places. This circumstance influenced me in favor of furrowing or guttering one track only, as, by the other track being left plain, vehicles cannot be injured by binding in the track. Again, in turning out, when one track alone is guttered, one half the labor only is necessary to overcome the obstacle. And further, by carriages entering upon the tracks, one only will be injured, and the jolts be less, where one gutter alone is dropped into. Add to all this, that one gutter will only cost half the amount of two, and I imagine the public will sanction the preference I have given.

As to tying the tracks together in the manner of railroad sills of wood, agreeably to Mr. Hartman's plan, and which is recognized in my patent, I shall not recommend it until experiment shall prove the necessity of it, not only on account of its expensiveness, but because almost every man's experience will convince him that at those intersections of timber against timber, decay will commence. At present I believe that timber well bedded in the road formation will be still enough and last longer, much longer, than for timber to be against timber. Where timbers are spliced, dowels or clamps may be necessary to join them, and where the substratum is likely to be soft, cross-blocks, of such a size as will support the joint, will be necessary.

In respect to forming the groove or gutter in the stick or out of the solid, I prefer it for similar reasons, as I am certain that the timber will be less likely to decay than where, by "attaching cheeks or sides to a plain surface," furrows or gutters are formed. All holes bored in timber, whether filled with spikes or trenails, and all joints or cracks in timber, should be carefully avoided, if we attend to the durability of it, particularly if exposed to the weather. And further, gutters or guides formed out of the solid will be less liable to derangement than those formed of "attached cheeks or sides," and I question if they will cost more, as laid timber may be ploughed as well as land, and in much the same way, and grooved as boards are grooved, and that by any sufficient motive power.

I hope, sir, that all those editors who have noticed Mr. Hartman's communication will give publicity to the above, as it will be adding interest to a subject of vital importance to the Union, and particularly those districts of it where stone is scarce and timber is plenty. The cheapness of the plan need not be doubted, and the liability of good timber to wear need not be feared, for more than two years of service upon timber here put down, agreeably to Mr. Hartman's proposition, convinces me of this. As to the freedom of timber from decay, where bedded in earth, I cannot ask you to publish so long an article as the investigation of that part of the subject makes in my report above mentioned; but I must crave the favor of you to publish the enclosed certificate of Col. Johnston, received since the report was printed. Col. Johnston was Indian Agent until within five or six years, and subsequently a Canal Commissioner in this state. He is one of the most amiable men of the west.

Yours, truly,

JNO. S. WILLIAMS

Cincinnati, Ohio, Aug. 10, 1833.

CERTIFICATE.

I came into the Indian Department in the service of the United States in Indiana and Ohio, soon after the operations of General Wayne's army had ceased, and the duties of my office frequently led me to travel over the roads, bridges, and causeways, made by the troops and artificers to facilitate the transportation of the munitions of war, and keep up the intercourse between the different stations and garrisons. It is within my recollection, that for upwards of twenty years after the making of those causeways, the timbers in many of them were perfectly sound, and I have no hesitation in saying that there were cases after a lapse of thirty years where they were sufficiently so to sustain the weight of the heaviest laden waggon.

JOHN JOHNSTON,
Formerly Agent for Indian Affairs in Ohio and Indiana.

Columbus, Ohio, Jan. 12, 1832.

AN ACT further to amend the several acts incorporating the Cincinnati, Columbus, and Wooster Turnpike Company:

Be it enacted by the General Assembly of the State of Ohio, that the President and Directors of the Cincinnati, Columbus, and Wooster Turnpike Company, be, and they are hereby authorised and empowered to construct any part of their said turnpike road on the plan of wood tracks, or timber laid lengthwise, on the principle recommended by John S. Williams, Engineer of said Company, in his report, dated December eighth, eighteen hundred and thirty one.

W. B. HUBBARD,
Speaker of the House of Representatives.

WM. DOHERTY,
Speaker of the Senate.

January 19, 1832.

ALDINI'S FIREMAN'S DEFENCE.—In our own times the art of defending the hands and feet, and indeed the whole body, from the action of heated iron and intense fire, has been turned to the noble purpose of saving human life, and rescuing property from the flames. The revival and improvement of this art we owe to the benevolence and ingenuity of the Chevalier Aldini, of Milan, who has travelled through all Europe to present this valuable gift to his species. Sir H. Davy had shown that a safety lamp, for illuminating mines containing inflammable air, might be constructed of wire gauze alone, which prevented the flame within, however large or intense, from setting fire to the inflammable air without. This valuable property, which has been long in practical use, he ascribed to the conducting and radiating power of the wire gauze, which carried off the heat of the flame and deprived it of its power. The Chevalier Aldini conceived the idea of applying the same material, in combination with other badly conducting substances, as a protection against fire. The incombustible pieces of dress which he uses for the body, arms, and legs, are formed out of strong cloth, which has been steeped in a solution of alum, while those for the head, hands, and feet, are made of cloth of asbestos, or amianthus. The head-dress is a large cap, which envelopes the whole head down to the neck, having suitable perforations for the eyes, nose, and mouth. The stocking and cap are single, but the gloves are made of double amianthus cloth, to enable the fireman to take into his hand burning or red hot bodies. The piece of ancient asbestos cloth preserved in the Vatican was formed, we believe, by mixing the asbestos with other fibrous substances; but M. Aldini has executed a piece of nearly the same size, nine feet five inches long, and five feet three inches wide, which is much stronger than the ancient piece, and possesses superior qualities, in consequence of having been woven without the introduction of any foreign substances. In this manufacture the fibres are prevented from breaking by the action of steam; the cloth is made loose in its fabric, and the threads are about the fiftieth of an inch in diameter.

The metallic dress, which is superadded to these means of defence, consists of five principal pieces, viz.: a *casque*, or cap, with a mask large enough to leave a proper space between it and the asbestos cap; a cuirass, with its brassets; a piece of armor for the trunk and thighs; a pair of boots of double wire gauze; and an oval shield, five feet long by two and a half wide, made by stretching the wire gauze over a slender frame of iron. All these pieces are made of iron wire gauze, having the intervals between its threads the twenty-fifth part of an inch.

In order to prove the efficacy of this apparatus, and inspire the firemen with confidence in its protection, he showed them that a finger first enveloped in asbestos, and then in a double case of wire gauze, might be held a long time in the flame of a spirit lamp or candle before the heat became inconvenient. A fireman, having his hand within a double asbestos glove, and its palm protect-

ed by a piece of asbestos cloth, seized with impunity a large piece of red hot iron, carried it deliberately to the distance of 150 feet, inflamed straw with it, and brought it back again to the furnace. On another occasion, the fireman handled blazing wood, and burning substances, and walked during five minutes upon an iron grating placed over flaming faggots.

In order to show how the head, eyes, and lungs are protected, the fireman put on the asbestos and wire gauze cap, and the cuirass, and held the shield before his breast. A fire of shavings was then lighted, and kept burning in a large raised chaffing-dish, and the fireman plunged his head into the middle of the flames, with his face to the fuel, and in that position went several times round the chaffing-dish, for a period longer than a minute. In a subsequent trial at Paris, a fireman placed his head in the middle of a large brazier filled with flaming hay and wood, as in the annexed figure, and resisted the action of the fire during five or six, and even ten, minutes.

In the experiments which were made at Paris in the presence of a committee of the Academy of Sciences, two parallel rows of straw and brushwood, supported by iron wires, were formed at the distance of three feet from each other, and extended thirty feet in length. When this combustible mass was set on fire, it was necessary to stand at the distance of eight or ten yards to avoid the heat. The flames from both the rows seemed to fill up the whole space between them, and rose to the height of nine or ten feet. At this moment, six firemen, clothed in incombustible dresses, and marching at a slow pace behind each other, repeatedly passed through the whole length between the two rows of flame, which were constantly fed with additional combustibles. One of the firemen carried on his back a child eight years old, in a wicker basket, covered with metallic gauze, and the child had no other dress than a cap made of amianthine cloth.

In February, 1829, a still more striking experiment was made in the yard of the barracks of St. Gervais. Two towers were erected two stories high, and were surrounded with heaps of inflammable materials, consisting of faggots and straw. The firemen braved the danger with impunity. In opposition to the advice of M. Aldini, one of them, with the basket and child, rushed into a narrow place, where the flames were raging eight yards high. The violence of the fire was so great that he could not be seen, while a thick black smoke spread around, throwing out a heat which was insupportable by the spectators. The fireman remained so long invisible that serious doubts were entertained of his safety. He at length, however, issued from the fiery gulf uninjured, and proud of having succeeded in braving so great a danger.

It is a remarkable result of these experiments, that the firemen are able to breathe without difficulty in the middle of the flames. This effect is owing not only to the heat being intercepted by the wire gauze as it passes to the lungs, in consequence of which its temperature becomes supportable, but also to the singular power which the body possesses of resisting great heats, and of breathing air of high temperatures.—[Brewster's Natural Magic.]

Description of an ancient Mexican Historical Manuscript. By Professor C. S. Rafinesque, Editor of the Atlantic Journal and Friend of Knowledge.

This singular manuscript is preserved in the library of the Philosophical Society of Philadelphia, and is a fac simile of another in Mexico. It was sent, I believe, by Mr. Poinsett.

It forms a roll about 10 feet long and 8 inches wide, divided into 30 compartments or scenes or events; from right to left, the principal names have been added in our letters.

It appears to relate to some of the earliest migrations of the Mexican nation, since it begins at a navigation by water and terminates at a third Colhuacan, a place of note in early

Mexican history. The times are denoted by feet or steps, or else by signs of years; but the chronology is rather confuse and obscure.

There is no connected similarity between this historical table and that of Siguenza, published by Gemelli, although they begin and end nearly in the same way. Pantitlan and Chapoltepec are the two only similar places in both.

Siguenza famous table relates to the migrations of the Aztlanecas or Aztecas, from Aztlan to Mixuahcan, with a chronology of 1608 years at most. This appears to relate to some other tribes of Colhuacans, with a chronology less extensive and regular.

To give a full description and comparison of these two interesting manuscripts, with explanations and translations, would require a memoir. It is chiefly my intention at present to draw attention on them, and suggest a few remarks on some of the scenes.

First scene, event, or place. *Ilhuitl Cacan Chiamoztoc*, (Ilhuitl means the sky or celestial.) This event is represented as in Siguenza by a square sea with a boat, but instead of a man laying down in the boat, are two men standing and paddling, which evidently alludes *to a voyage by sea, and from the east or through the Atlantic.* There is, besides, a teocalli, temple or island in it, with a tree on it, but no bird; and two men below outside, one sitting and one kneeling. Date 3 years or balls.

2d scene. *Panhuataque.* Dates 1 year and 3 feet or steps, probably meaning stations of migration.

3. First *Colhuacan* (meaning holy old place,) this is the name given by the Mexicans to the immense ruin of Otolum near Palenque. It is figured by a mountain like a phrygian cap, with 9 tongues or people, and 8 speaking sitting men or tribes in a row, 6 steps, &c. 3 sheaths or ages next.

4. *Chimalman.* 5. *Quetzaletl.* 6. *Cuauheohuitl.* 7. Cohuatl. Four travellers with loads, a step under each and between each, thus 7 steps or feet or stations.

8. *Onca quitlamanlique nyzcoatl.* A tree, a teocalli, a danse of 5 men, 5 years, 4 steps.

9. *Oncan quinnotz nyzcoatl.* 2 men, 7 steps, 2 before, 2 above, 3 after.

10. *Cueztecatl Chocayan.* 2 cones, a man speaking, 3 steps.

11. *Cohuatl Camac.* An alligator, 4 steps.

Here begin the astronomical cycles of 13 years, figured by symbolic squares. From 12 to 18 scenes nameless.

12. Four men or tribes sitting, 28 years.

13. Four men in a square, 7 steps, 24 years.

14. Ditto, 4 steps, ten years.

15. Ditto, a cornucopia, 3 steps, 5 years.

16. Ditto, 5 years, 3 steps, 4 men beyond.

17. A cone, a sword, 3 tongues, 12 years.

18. Four men, 3 steps, 4 years.

19. *Axcapozalco* (well known city). 4 men, 4 years. 5 steps.

20. *Acalhuacan* or the second *Colhuacan.* 4 men, a spade, 4 years, 4 steps.

21. *Ecatepec* (Wind Hill). Cone, 4 men, 3 steps, 4 years. Second part, 4 men, 3 steps, 8 years.

22. *Cohuatitlan* (snake place). Snake, 4 men, 5 steps, 20 years. Second part, 4 steps 4 years.

23. *Teopaiocan.* Cone, sword, 3 tongues, 4 men, 3 steps, 4 years.

24. *Pantitlan* (passage place), divided in 6 parts, all with the 4 men or tribes as usual. First has 3 steps, 4 years. 2d, 3 steps, 8 years, and here appears the first symbol of a king sitting. 3d and 4th, each 3 steps, 4 years. 5th, has a sheaf or age of 104 years, 8 years besides, and 3 steps. 6th, 4 steps, 4 years.

25. *Atlacuihuaan.* 3 steps, 4 men, 4 years.

26. *Chapoltepec* (Locust Hill). 4 steps, 4 men, 20 years, 5 steps. 2d part, below 6 steps round a circle, 2 men kneeling to 2 men sitting, 5 sheaths or ages of 520 years.

27. *Chimalazotl.* 3 steps, a warrior leading a slave.

28. *Huitzilihuitl.* 3 steps, a warrior leading a slave to the king *Cozcozth* sitting. This is the *Coxcox* of Aztecas, to whom they become slaves, and therefore these annals refer to those tribes who enslaved them, under *Cuxcux*, 14th king of the Chichimecas or Acolhuans.

29. Third *Colhuacan.* A mountain, 2 steps, 4 years, 2 men, a vase between them.

30th and last scene or event, nameless. Three kings sitting, 2 steps, several men, a cone below. End of the whole, 3 men and 2 soldiers with swords and tongues.

The whole number of computed years from the 12th scene, amounts to 816 years before the subjugation of the Aztecas and the building or occupation of the third Colhuacan, the date of which is in 1314, therefore the beginning of these annals go to the year 498 of our era; but how much earlier in the previous ages is uncertain. It appears that they dwelt 3 ages or 312 years in the first Colhuacan. If the feet or steps denote

times or cycles, the chronology would be changed and increased. It is desirable that this manuscript should be engraved.

On the Study of Wild Nature.—To observe *nature*, we must go to the wilds, because in all cultivated productions there are secondary characters produced by the artificial treatment, and we have no means of observing a distinction between these and those which the same individual would have displayed, had it been left to a completely natural state. The longer that the race has been under domestication and culture, the changes are of course the greater. So much is that the case, that in very many, both of the plants and animals that have been in a state of domestication since the earliest times of which we have any record, we know nothing with certainty about the parent races in their wild state. As to the *species*, or, if you will, the *genus*, we can be certain. The domestic horse has not been cultivated out of an animal with cloven hoofs and horns; and the domestic sheep has never been bred out of any of the ox tribe. So also wheat and barley have not been cultivated out of any species of pulse, neither have windsor beans at any time been grasses. But within some such limits as these our certain information lies; and for aught we know, the parent race may, in its wild state, be before our eyes every day, and yet we may not have the means of knowing that it is so. The breeding artificially has been going on for at least three thousand years, with some change at every succession; that, calling the average duration of the domestic animal ten years, and that of the bread-plant one year, is three hundred successions in the one case, and three thousand in the other; and what man is to live, nay, what kingdom is to last, till the experiment is performed as many times, with any thing which is now in a state of nature! Even if we were to suppose that impossibility got the better of, there arises another every way as perplexing. How are we to know what was the first artificial mode of treating any one of those cultivated productions, or what were the effects of it, even at the end of one thousand or of two thousand years? Fashions of cultivation change as much as fashions of any thing else; and as the subject is one in which it is impossible to get accurate information upon, not a few only, but on many points, much of the change must have been theoretical; and, like all theoretical procedure, sometimes an improvement, and sometimes the reverse. But there is another difficulty. What great changes are made on the surface of a country, as when forests are changed into open land, and marshes into corn fields, or any other change that is considerable, the changes of the climate must correspond; and as the wild productions are very much affected by that, they must also undergo changes; and these changes may in time amount to the entire extinction of some of the old tribes, both of plants and of animals, the modification of others to the full extent that the hereditary specific characters admit, and to the introduction of not varieties only, but of species altogether new.

That not only may, but must, have been the case. The productions of soils and climates are as varied as these are; and when a change takes place in either of these, if the living productions cannot alter their habits so as to accommodate themselves to the change, there is no alternative, but they must perish. Also, though we know nothing about the primary germs of plants or of animals, till we find them developed in visible and tangible embryos, we must not make our ignorance the measure of nature's working; for though we have seen them come only in one way, and, generally speaking, perish in another, we are not to suppose that that is all. When forests of one kind of timber are cut down, new plants make their appearance; and there are evidences that races, both of plants and of animals, have perished even in our own country, without any great convulsion of nature, for their remains have been left on the strand and buried by the slow progress of the deposition of the matter washed down by the rains and stayed by the re-action of the waves.

Cultivation itself will deteriorate and in time destroy races, if the same race and the same mode of culture be pursued amid general change. Our own times are times of very rapid change, and, upon the whole, of improvement; we dare not, without the certainty of their falling off, continue the same stock and the same seed-corn, season after season, and age after age, as was done by our forefathers. The general change of the country must have change, and not mere succession, in that which we cultivate; and thus we must cross the breeds of our animals, and remove the seeds and plants of our vegetables from district to district.

There is something of the same kind in

human beings, and we have reason to expect that there should; because, in as far as man is material and mortal, he is just as dependent upon circumstances as any other material production. Hence we find that when a town or a district is busy and bustling, and strangers resort to it, both the population and the energy increase far faster than the numerical addition of strangers. But, on the other hand, when it becomes dull, and strangers cease to resort to it, it dies away, both in population and in mental energy, even though none of the people leave it. Thus, it is not leisure that mankind needs, it is stimulus and activity; and study, even the most profuse and abstruse study, thrives better in the few snatches of time which the busy man can spare for it, than in all the listless and loitering days of him who has nothing to do.—[Mudie.]

Means employed by the Spider in weaving its Web.—We find, in the introduction to Entomology by Kirby and Spence, a very curious description of the means employed by spiders in warping their webs. The author, after having described the four little spiders, as they call them, which produce a visible silk, explains the procedure of this little insect, whose work he compares to the spinning wheel of the rope maker. Each spider is pierced with an infinite number of holes, like the drawing plate of a gold wire drawer, and these holes are so small and tight, that the space which a pin would occupy would contain more than a thousand such. From each of these issues a thread of inconceivable fineness, which instantly unites with the others to form but one. The four spiders each making their thread in the same manner and in the same time, the result is that there are four threads alike, which, at the distance of about a tenth of an inch, re-unite also to form the silk that we are accustomed to see, and which the spider makes use of to spin her web. Thus the thread of a spider drawn by the smallest species, and so delicate that the eye can scarcely perceive it, is not, as is generally thought, a single thread, but in reality a cord, which contains not less than four thousand of them.

But to understand perfectly this wonder of nature, it is necessary to follow the calculations made by the learned Leuwenhoeck, agreeably to his microscopic observations. He has found that the thread of the smallest spider, of which some are not as large as a grain of sand, were of such a fineness that it would be necessary to unite more than four millions to form the thickness of a hair. Now we know that each one of this series is already composed of four thousand threads; it follows then that sixteen millions of these threads, drawn by the little spider, have not together the thickness of a hair.—[Jour. des Con. Usuel.]

Liberty and Knowledge.—The Congress of the United Mexican States have appropriated *thirty thousand dollars* for the purchase of periodical publications—almost all of which are, of course, to be imported from foreign countries. The bill, as passed by the House of Representatives, appropriated $25,000; but on being increased by the Senate, was adopted with their amendment. Our countrymen will believe that the Mexicans are in earnest in the pursuit of national happiness, by the only means, viz. the improvement of the people, when they see the government adopting measures that reflect so much honor upon their judgment and their feelings.

Slate.—Slates used in schools and for the roofs of houses are procured from deposits of rocks, which are among the most abundant upon our globe. This rock is frequently associated with mica slate, already described, and is generally found with the oldest rocks, but sometimes with those of a more recent formation. When it occurs with granite, gneiss, or mica slate, it overlays them, and is seldom found beneath them. It sometimes occurs with greenstone, sienite, and limestone.

The strata or layers of common slate are seldom horizontal, commonly oblique, but sometimes vertical.

Various parts of the United States abound with this rock, and from the several deposits, specimens of various qualities are procured. Some quarries furnish specimens fit for schools, others contain an abundance fitted for roofing houses, and many others contain a coarser material, but useful in various departments of architecture.

It is found in all the Atlantic states; and in Maine, Massachusetts, Pennsylvania, Maryland, and some of the more southern states, it is wrought in quantities as an article of commerce. The greatest quantity of slate, however, used in our cities, is brought from Ireland, or some other part of Europe.

The simple elements in slate, sometimes

called argillite or argillaceous slate, are oxygen, carbon, and hydrogen. The oxygen is combined with six different metals, so as to produce silex, alumine, magnesia, potash, oxid of iron, and oxid of manganese.

Slate being a homogeneous substance, or of a uniform appearance and character throughout, it is called a simple mineral, and placed among the letters of the geological alphabet. As it is found in extensive ledges and deposits, it is of itself a rock, and hence has the two-fold character of a mineral and a rock.

AGES OF TREES.—According to the last Journal of Health there are some very aged trees in the world. De Candolle, a writer on the subject, thinks he has proved, in some way which satisfies him, that there are trees in the world of the ages annexed to their names below: An elm, 335 years; cypress, about 350; ivy, 450; larch, 576; orange, 630; olive, 700; oriental plane, more than 720; cedar of Lebanon, about 800; oaks, 810, 1080, 1500; lime, 1076, 1148; yew, 1214, 1458, 2588, 2880; taxodium, 4000 to 6000; baobab, 5150. The baobab is a tree of Africa, which has a trunk sometimes 60 to 80 feet in circumference, although it is scarcely a dozen feet high. With the taxodium and larch we are unacquainted.

EMINENCE ATTAINED BY MEN OF LOW ORIGIN.—Many of the most eminent men in literature, science, and art, have sprung up in obscurity. Some will instantly occur to the mind from among the living as well as the dead, who have laid society under the deepest obligation; but there are others whose claims are not so commonly remembered. It is calculated, for instance, that above a million and a half chaldrons of coals are annually consumed in London; and the amazing extension of the coal trade to meet such demands is to be traced to men called "viewers," who have generally raised themselves from lower situations. Machinery was absolutely necessary to obtain so many millions of tons of the first necessaries of life, and that at a rate exceedingly low; and this was provided by Newcomen, the plumber, and Smea and Watt, the watchmakers. The cheap and elegant garments, which give bread to about two millions of people, instead of fifty thousand, which raised the importation of cotton wool from less than 2,000,000 to 200,000,000 pounds per annum, and which increased the annual produce of the manufacture from 200,000 to £36,000,000, are to be traced through subsequent improvements to Arkwright and Crompton, the barbers. A rude and inconsiderable manufacture was changed into an elegant art, and an important branch of national commerce, by Wedgewood, the potter. Inland navigation, which enabled manufacturers to import the raw materials and export the finished goods, was devised and executed by Brindley, the millwright; and it would be easy to accumulate a great number of instances in which persons of humble birth have greatly promoted the general good.—[Wilderspin's Early Discipline.]

"WHAT WILL PEOPLE SAY!"—This single phrase is the cause of much indecision of character. He who is guided in his actions only by reference to the opinions of others, has set a *will o' wisp* beacon that will lead him farther in the morass than he at first thought possible. If a man, instead of assuming sound undeviating principles as his guide, is influenced by only what his neighbors will say of him, he will soon find himself plunged into the uncertain and inextricable quicksand of indecision of character. To be under a constant nervous apprehension of the opinion of one's neighbors, is to be in one continual fever of the mind. Desirous of winning the good opinion of all, even at the sacrifice of just and inimitable principles, the poor victim steals along, now veering to the one side, now to the other, watching the minutest token that would indicate a change in public sentiment, so that he may be prepared to catch the fanning of the popular breeze. Such a character is as contemptible as it is wretched. Let each one walk forth amid his fellow men, strong in the feeling of conscious innocence and upright integrity, determined to perform the duties that devolve upon him, unmindful of the noisy clamors that may assail his path. Such an one will play his part on the stage of life, unmindful alike of empty praise and abusive tongues. Careless of what "people say," he pursues his own undeviating course, and is finally cheered with the plaudits of the discerning and estimable, soothed by the peace and calm of a conscience void of offence.

WOMAN.—To the honor, to the eternal honor of the sex, be it said, that in the path of duty no sacrifice is with them too high, or too dear. Nothing is with them impossible, but

to shrink from what love, honor, innocence, religion, requires. The voice of pleasure or of power may pass by unheeded, but the voice of affliction never. The chamber of the sick, the pillow of the dying, the vigils of the dead, the altars of religion, never fail to excite the sympathies of woman. Timid though she be, and so delicate that the winds of heaven may not too roughly visit her, yet she fears no danger, nor dreads no consequences. Then she displays that undaunted spirit which neither courts difficulties nor evades them; that resignation which utters neither murmurs nor regret; and that patience in suffering which seems victorious even over death itself.—[Judge Story.]

CURIOUS RECORD.—Mr. Madden, in his work entitled the "Infirmities of Genius Illustrated," presents us with a curious record of the average influence of different studies on the longevity of those engaged in them. The record consists of a tabular arrangement, in which are several series of the most celebrated authors in the various departments of intellectual labor. Twenty persons are included in each list; the names and ages of each are given, and from the united amount of the latter is taken the average age to which the members of each of the classes survive.

The first table includes *Natural Philosophers*, whose names and ages are as follow: Bacon, (Roger,) 78; Buffon, 81; Copernicus, 70; Cuvier, 64; Davy, 51; Euler, 76; Franklin, 85; Galileo, 78; Dr. Halley, 86; Herschel, 84; Kepler, 60; Lalande, 75; Laplace, 77; Lewenhoeck, 91; Leibnitz, 70; Linnæus, 72; Newton, 84; Tychobrahe, 55; Whiston, 95; Wollaston, 62.

The second table is that of *Poets*—Ariosto, 59; Burns, 38; Byron, 37; Camoens, 55; Collins, 56; Cowley, 49; Cowper, 69; Dante, 56; Dryden, 70; Goldsmith, 44; Gray, 57; Metastasio, 84; Milton, 66; Petrarch, 68; Pope, 56; Shenstone, 50; Spencer, 46; Tasso, 52; Thomson, 48; Young, 84.

The contents of the remaining tables are as follow:

Moral Philosophers—Bacon, 65; Bayley, 59; Berkeley, (G.) 79; Condorcet, 51; Condillac, 65; Descartes, 54; Diderot, 71; Ferguson, (A.) 92; Fichte, (J. T.) 52; Hartley, (D.) 52; Helvetius, 57; Hobbes, 91; Hume, 65; Kant, 80; Kames, 86; Locke, 72; Malebranche, 77; Reid, (T.) 86; Stewart, (D.) 75; St. Lambert, 88.

Dramatists—Alfieri, 55; Corneille, 78; Goethe, 82; Massinger, 55; Marlow, 32; Otway, 34; Racine, 60; Schiller, 46; Shakspeare, 52; Voltaire, 84; Congreve, 59; Colman, (G.) 61; Crebillon, 89; Cumberland, 80; Farquhar, 30; Goldoni, 85; Jonson, (B.) 63; Lope de Vega, 73; Moliere, 53; Murphy, 78.

Authors on Law and Jurisprudence—Bentham, 85; Blackstone, 57; Butler, (C.) 83; Coke, 85; Erskine, 73; Filangieri, 36; Gifford, 48; Grotius, 63; Hale, 68; Holt, 68; Littleton, 75; Mansfield, 88; Montesquieu, 66; Redesdale, 82; Romilly, 61; Rolle, 68; Tenderden, 78; Thurlow, 74; Vattel, 53; Wilmot, 83.

Miscellaneous and Novel Writers—Cervantes, 70; Le Sage, 80; Scott, 62; Fielding, 47; Smollett, 51; Rabelais, 70; Defoe, 70; Ratcliffe, 60; Richardson, 72; Sterne, 56; Johnson, 75; Addison, 48; Wharton, 78; Steele, 59; Tickell, 54; Montaign, 60; Bathurst, (R.) 84; Thornton, 44; Hawkesworth, 59; Hazlitt, 58.

Authors on Revealed Religion—Baxter, 76; Bellarmine, 84; Butler, (John,) 60; Bossuet, 77; Calvin, 56; Chillingworth, 43; Doddridge, 54; Fox, (G.) 67; Knox, (John,) 67; Lowth, 77; Luther, 63; Massillon, 79; Melancthon, 64; Paley, 63; Porteus, 77; Priestley, 71; Sherlock, 67; Wesley, 88; Whitefield, 56; Wycliff, 61.

Authors on Natural Religion—Annett, 55; Bolingbroke, 79; Cardan, 75; Chubb, 65; Drummond, (Sir W.) 68; Dupuis, 67; Freret, (N.) 61; Gibson, 58; Herbert, (Lord,) 68; Jacobi, 56; Paine, 72; Pomponatius, 63; Rosseau, 66; Spinoza, 45; St. Pierre, 77; Shaftsbury, 42; Tindal, 75; Toland, 53; Vanini, 34; Volney, 66.

Medical Authors—Brown, (J.) 54; Corvisart, 66; Cullen, 78; Darwin, 72; Fordyce, 67; Fothergill, 69; Gall, 71; Gregory, (John,) 48; Harvey, 81; Heberden, 92; Hoffman, 83; Hunter, (J.) 65; Hunter, (W.) 66; Jenner, 75; Mason, Good, 64; Parcelsus, 43; Pinel, 84; Sydenham, 66; Tissot, 70; Willis, (T.) 54.

Philologists—Bentley, 81; Burton, 64; Casaubon, 55; Cheke, 44; Hartzheim, 70; Harman, (J.) 77; Heyne, 84; Lipsius, 60; Parr, 80; Pauw, 61; Pighius, 84; Porson, 50; Raphelengius, 59; Salmatius, 66; Scaliger, (J. J.) 69; Sigonius, 60; Stephens, (H.) 71; Sylburgious, 51; Vossius, 73; Wolfius, 64.

Artists—Bandinelli, 72; Bernini, 82; Canova, 65; Donatello, 83; Flaxman, 71; Chi-

berti, 64; Giotto, 60; Michael Angelo, 96; San Sovino, 91; Verocchio, 56; Caracci, (A.) 49; Claude, 82; David, 76; Guido, 67; Raphael, 37; Reynolds, 69; Salvator Rosa, 58; Titian, 96; Veronese, (Paul,) 56; West, 82.

Musical Composers—Arne, 68; Bach, 66; Beethoven, 57; Burney, 88; Bull, 41; Cimarosa, 41; Corelli, 60; Gluck, 75; Gretry, 72; Handel, 75; Haydn, 77; Kalkbrenner, 51; Keiser, 62; Martini, 78; Mozart, 36; Paisello, 75; Piccini, 71; Porpore, 78; Scarlatti, 78; Weber, 40.

The result, then, that we derive from these tables, is that natural philosophers have the longest lease of existence, the united ages of the twenty enumerated being 1504 years, which gives an average of 75 years for each. The results in the other cases, with respect to the united ages, and the average each, are: Moral philosophers, united ages, 1417—average of the life of each, 70; sculptors and painters, 1412—70; authors on law and jurisprudence, 1394—69; medical authors, 1368—68; authors on revealed religion, 1350—67; philologists, 1323—66; musical composers, 1284—64; novelists and miscellaneous authors, 1257—62½; dramatists, 1249—62; authors on natural religion, 1245—62; poets, 1144—57. According to the results of this calculation, it would appear that those mental labors in which the imagination is most actively employed are least conducive to long life. Other conclusions with respect to different occupations are drawn by Mr Madden, who seems to be of opinion that an exact scale may be laid down, by which, the particular occupation of any person being given, the probable length of his life may be determined.

Danger of Mental Excitement.—On this point, the opinions of the most celebrated physicians seem to be unanimous. Tissot remarks: "Long continued application in infancy destroys life. I have seen young children, of great mental activity, who manifested a passion for learning far above their age, and foresaw, with grief, the fate that awaited them; they commenced their career as prodigies, and finished by becoming idiots, or persons of very weak minds. No custom is more improper or cruel than that of some parents, who exact of their children much intellectual labor, and great progress in study. It is the tomb of their talents and of their health." Hufeland says, that, by too early study, "the nervous system acquires a predominance over all others, which it preserves for the remainder of life; producing innumerable nervous complaints, melancholy, hypochondria, &c." Satier, in a prize essay on this subject, remarks, "The labor of the mind, to which some parents subject their children not only too soon, but in a wrong direction, is often the cause of their bad health, and causes nearly all those who are distinguished by precocity of the intellectual faculties to perish prematurely, so that we seldom see a *perfect man:* that is, one who exhibits an equilibrium of the physical, mental, and moral faculties." A late writer on dropsy in the head observes, that "the present education, in which the intellectual powers are prematurely exercised, may be considered as one of the causes of the more frequent recurrence of this disease." Dr. Jackson remarks, "In an early age, before the organism has acquired its proper developement, the brain its perfect consolidation, or the organs are confirmed in the order of their existence, premature exercises of their intellectual faculties are the source of many disorders. By the undue excitement of the brain, its organic functions are augmented unnaturally; the organic actions of the organs of nutrition, secretion, &c. are enfeebled; the muscular system becomes morbidly irritable; and the brain subject to a variety of affections. Those highly gifted with precocious intellects possess miserable health, and are generally short-lived; they are cut off by chronic inflammations, and disorganization of their viscera, or by acute inflammation of the brain." In addition to these immediate evils, the tendency of excessive mental excitement to produce insanity is well established, and an additional ground for caution. The registers of hospitals, and the history of different periods of the world, and the statistics of insanity in several countries, sufficiently show this. Statesmen, politicians, and literary men, are most frequently subject to derangement. This disease is uncommon in China, Turkey, Spain, and Russia, where, from the structure of government and the habits of the people, the mind is little excited. It is more prevalent in France and central Europe. England, with more intelligence and activity of mind, has more insanity than any other country in Europe; and, if recent calculations may be relied upon, the United States have more than twice as many deranged persons, in proportion to their population, as any other country in the world. The intense activity

of mind, produced by the universal instruction of the people, and the strife for wealth and power, to which all are led by the institutions and habits, are doubtless among the causes of this sad difference.

New Application of Steam.—We have already mentioned the invention, by Mr. Murfree, of Nashville, of a new mode of applying the power of steam directly to the periphery of a wheel, and thus dispensing with the cumbrous, expensive, and bulky apparatus required, upon the old plan, between the generator and the machinery intended to be operated upon. This invention, however, deserves a more extended and elaborate notice. It has only been tried upon a small scale, but as it has, in that form, succeeded beyond expectation, and as the principle must be the same in larger engines, there is no reason to doubt its entire success in its practical application to the business of life. We have examined the model of a saw-mill, and seen it in operation, by means of this new contrivance. The driving wheel is formed, as usual, with arms or spokes inserted in an axis or hub, and supporting the periphery or rim, upon one edge or side of which are placed a number of buckets, proportioned to the size of the wheel, and to the column of steam intended to be applied. One or more pipes, proceeding from the generator, conduct the steam to these buckets, and throw it upon them at an angle of 45°, so that it escapes continually after producing its effect, without any re-action to retard the motion it has created. The application may be made so as to drive the wheel in any direction, vertically, horizontally, or at an inclination.

The wheel in the model we have seen is two feet in diameter. The saw-mill driven by it is constructed upon a proportionate scale, and upon Overman's plan; the supply pump is of the usual construction, and the generator is 36 inches long, and 15 in diameter, furnishing a column of steam three and one-third sixteenths of an inch square, under a pressure of fifteen pounds. The saw of this little machine cuts about twenty-seven square inches of timber a minute, and it is the opinion of the inventor, that the same generator is capable of furnishing a power sufficient to cut regularly forty-eight square inches a minute.

From the experiments already made, it is believed that the generator now used may furnish, upon this plan, one and a half horse power. The wheel, when we saw it in motion, made about 560 revolutions a minute, giving to the periphery a velocity of 3360 feet. The saw made about 280 and the supply pump 140 strokes a minute, the axis of each being about 9 inches in diameter, so that the momentum of the machine may be estimated at about 4000 superficial feet a minute. The great advantage of this invention is the direct application of the power to the wheel, without the necessary intervention of any bulky machinery. So far as we can judge from the experiments made, this important object is fully attained.—[Nashville Banner.]

Sayings for Mechanics and Farmers.—1. Sloth, like rust, consumes faster than labor wears, whilst the used key is always bright.

2. Dost thou love life? Then do not squander time, for that is the stuff life is made of.

3. The sleeping fox catches no poultry.

4. He that riseth late must rot all day, and shall scarce overtake his business at night.

5. Early to bed, and early to rise, makes a man healthy, and wealthy, and wise.

6. He that lives upon hope will die fainting—industry need not wish.

7. There are not gains without pains.

8. At the working man's house hunger looks in, but never enters.

9. Plough deep while the sluggards sleep, and you shall have corn to sell or keep.

10. *One to-day* is worth *two to-morrow.*

11. Handle your tools without mittens—a cat in gloves catches no mice.

12. He that by the plough would thrive, himself must either hold or drive.

13. The eye of a master will do more work than both his hands. Not to oversee workmen is to leave them your purse open.

14. A little negligence may breed a great mischief: for want of a nail the shoe was lost, for want of a shoe the horse was lost, and for want of a horse the rider was lost.

15. A fat kitchen makes a lean will.

16. If you would be rich, think of saving as well as getting.

17. What maintains one vice would train up two children.

18. Beware of little expense—a small leak will sink a great ship.

19. If you would know the want of money, go and try to borrow some—for he that goes borrowing goes sorrowing.

20. Pride is as loud a beggar as want, and a great deal more saucy.

21. Pride breakfasted with plenty, dined with poverty, and supped with infamy.

22. Lying rides on debt's back.

23. It is hard for an empty bag to stand upright.

24. Creditors have better memories than debtors.

25. For age and want save what you may, no morning's sun lasts the whole day.

26. Rather go to bed supperless, than rise in debt.

27. If you do not hear reason, she will surely rap your knuckles.

28. He that hath a trade hath an estate: and he that hath calling hath a place of profit and honor. A ploughman on his legs is higher than a gentleman on his knees.—[Dr. Franklin.]

UNIVERSAL EDUCATION.—*Washington*, in his farewell address, thus advises his fellow citizens:

"Promote, as an object of primary importance, institutions for the general diffusion of knowledge. In proportion as the structure of a government gives force to public opinion, it is essential that public opinion should be enlightened."

A similar testimony appears in the President's Message to Congress, December 5, 1810:

"While it is universally admitted that a well instructed people alone can be a permanently free people, and while it is evident that the means of diffusing and improving useful knowledge form so small a proportion of the expenditures for national purposes, I cannot presume it to be unreasonable to invite your attention to the advantage of superadding to the means of education provided by the several States, an institution supported by the national legislature, which, by enlightening the opinions, expanding the patriotism, and assimilating the principles, the sentiments and manners, of those who resort to it, would contribute not less to strengthen the foundation than to adorn the structure of our free and happy form of government."—JAMES MADISON.

"By far the most important bill in our own code is that for diffusing knowledge among the people. No other sure foundation can be devised for the preservation of freedom and happiness. Make a crusade against ignorance, establish and improve the law for educating the common people. Let our countrymen know that the people alone can protect us against these evils (of aristocratical Europe)."—THOMAS JEFFERSON.

"For the purpose of promoting the happiness of the State, it is absolutely necessary that our government, which unites into one all the minds of the State, should possess, in an eminent degree, not only the understanding, the passion, and the will, but, above all, the moral faculty and the conscience of an individual. Nothing can be politically right that is morally wrong; and no necessity can ever sanctify a law that is contrary to equity. Virtue is the soul of a Republic. To promote this, laws for the suppression of vice and immorality will be as ineffectual as the increase and enlargement of jails. There is but one method of preventing crimes, and of rendering a republican form of government durable; and that is, by disseminating the seeds of virtue and knowledge through every part of the State by means of proper modes and places of education; and this can be done effectually only by the interference and aid of the legislature. I am so deeply impressed with this opinion, that, were this the last evening of my life, I would not only say to the asylum of my ancestors and my beloved native country, with the patriot of Venice, *Esto perpetua*, but I would add, as the best proof of my affection for her, my parting advice to the guardians of her liberties, *to establish and support* PUBLIC SCHOOLS *in every part of the State.*"—BENJAMIN RUSH.

The following was addressed by the lamented patriot and statesman, Tompkins, to the New-York Legislature:

"I cannot omit inviting your attention to the means of instruction for the rising generation. To enable them to perceive and duly estimate their rights, to inculcate correct principles and habits of morality and religion, and to render them useful citizens, competent provision for their education is all-essential."—DANIEL D. TOMPKINS.

"The reciprocal action of knowledge and free government on each other partake in some measure of *identity;* for wherever liberty is firmly established, knowledge must be a necessary concomitant. And if we desire to occupy this exalted ground—if we wish to improve, to extend, and perpetuate the blessings of freedom, it is essential, absolutely essential, to improve, to extend, and perpetuate the blessings of education.

"Education is the guardian of liberty and the bulwark of morality. Knowledge and virtue are generally inseparable companions,

and are, in the moral, what light and heat are in the natural world—the illuminating and vivifying principle.

"A republican government is certainly most congenial with the nature, most propitious to the welfare, and most conducive to the dignity of our species. Man becomes degraded in proportion as he loses the right of self-government. Every effort ought, therefore, to be made to fortify our free institutions; and the great bulwark of security is to be found in education: the culture of the heart and head, the diffusion of knowledge, piety, and morality. A virtuous and enlightened man can never submit to degradation; and a virtuous and enlightened people will never breathe the atmosphere of slavery. Upon education we must, therefore, rely for the purity, the preservation, and the perpetuation of republican government. In this sacred cause we cannot exercise too much liberty: it is identified with our best interests in this world. Much, indeed, has been done, and we have only to cast our eyes over our State, and rejoice in the harvest which it has already yielded. But much more remains, and ought to be done."—De Witt Clinton.

"The improvement of the mind should be the first care of the American statesman, and the dissemination of learning and knowledge ought to form one of the principal objects of his ambition. Virtue and intelligence are the only appropriate pillars upon which a Republican government can securely rest; without these, liberty itself would soon degenerate into licentiousness, and our free and liberal institutions, so highly cherished by ourselves, and so much admired and respected by the wise and patriotic of other nations, would be engulphed in anarchy, and become the reproach of the friends and the derision of the enemies of the equal rights of man in every quarter of the globe."—George Wolfe.

"The policy of all our laws is to secure a good common school education to every child in the State; and the condition of the children who are employed in the manufactories, as to their means of instruction, ought to be carefully inquired into and provided for. The diffusion of education among all classes of our population is deemed of such vital importance to the preservation of our free institutions, that if the obligations which rest upon every good citizen, in this particular, are disregarded, the persons having the custody of such children ought to be visited with such disabilities as will induce them, from interest, if not from principle, to cause the children to be instructed, at least in reading, writing, and arithmetic.

"Intelligence has been regarded as the vital principle of a free government; and every parent, guardian, or master, who neglects or refuses to give the children under his charge the advantages of a common school education, particularly in cases where the instruction is offered "without money and without price," is as much an offender against the State as the man who refuses to perform any other duty which is deemed essential to the preservation of our liberties."—Azariah C. Flagg.

Support your Mechanics.—There is scarcely any thing which tends more to the improvement of a town, than a fair and liberal support afforded to Mechanics of every description. Population is necessary to the prosperity of any country; and that population, being of an honest and industrious character, renders prosperity more certain, uniform, and unvarying. Scarce any place has ever yet risen to much importance, even when possessed of the most commercial advantages, without a true regard to the encouragement of the mechanical arts. For, though the exportation of produce and the importation of merchandize form the leading features of such a place, the various arts of mechanism are invariably called in requisition, and are indispensable to render the progress of commercial operations safe. To an inland town mechanics are equally important as elsewhere. They constitute a large and respectable portion of society in all countries, but in towns and villages they are almost a leading constituent part of their growth and population.

To afford ample support to a class of citizens so highly useful and necessary is certainly the duty of those engaged in other pursuits. Some branches of mechanism have to sustain no competition from abroad, the nature of their business preventing any such inroads or interference; others are, however, subject to be innovated by the importation of similar articles of foreign produce made for sale, and often, by their apparently lower rates, induce a preference over our own productions. Although trade and commerce in all their various branches should be free and unshackled, a regard for the growth and prosperity of our village should induce us to afford a reasonable support to

our mechanics; we should at least give them preference when we are no losers by it. A little experience will have convinced many that it is, in most cases, their interest to do so, independent of any other considerations.

Delayed Improvements. By Prof. C. S. Rafinesque. [Communicated for the Mechanics' Magazine.]

It is a sad but positive fact, that almost all the greatest improvements have been resisted and opposed, or at least their introduction long delayed in this country, although they might be evidently practicable, useful, and even cheaper. We may remember the opposition to steamboats, canals, &c. as an instance, and the long delay in introducing lithography, railroads, tunnels, slate roofs, and a hundred other useful arts. The slow progress of the useful and valuable staples of wine and silk, so well calculated for our soil and climate, is another instance in point. The same has happened with education. There were schools for the deaf and dumb, also for the blind, 50 or 60 years ago in Europe, while they are just beginning here The Fellenberg schools are hardly adopted with us. Free colleges and libraries are common even in despotic countries, and we have hardly any as yet. Hundreds of improvements and peculiar manufactures have not yet reached our shores. Our ingenious men and mechanics are often compelled to carry their inventions abroad. Our patent laws are sadly defective; striking improvements are neglected, although brought forward at great expense; when valuable, they are stolen, and the remedy at law is often beyond the reach of many.

Our country is making rapid strides in prosperity, wealth and population; but greater strides are yet to be made, through improvements of all kinds, and a judicious selection or application of the actual, well known, practicable improvements.

Thus, it is well known that trees can be removed root and all, and land perfectly cleared at once by machines, and at little expense; that steam ploughs could be constructed that would, in level or cleared land, perform the work of six ploughs and twelve horses, at one sixth part of the time and expense, cutting six furrows at once, and reducing one week's labor on a farm to one single day's labor. This is well known, and yet not in use, although calculated to achieve wonders in agricultural pursuits.

It is well known to some, that railroads can be constructed that are carried along by the cars, which supercede the use of railroads and durable tracks, and only require level M'Adam roads; yet we are going to build a thousand miles of railroad, and waste on them ten millions of dollars.

It is known that ships and steamboats may be built that can never sink, even when striking against rocks and ice, or quite wrecked. Even the Chinese knew something of the kind 2000 years ago; yet we daily build merchant ships and ships of war liable to sink and be lost, as many are every year, even in our national navy, besides steamboats, &c.

It is known that houses and ships may be built that can never catch fire, nor burn. There are cities in the world, as large as New-York, where a fire does not happen once in ten years, and even then burns only the contents of the houses and not the houses themselves; yet we continue to build combustible houses, and doom ourselves to be burned alive, as many are every year throughout these States.

All this arises from inveterate bad habits and ignorance; because we neglect to apply to and employ the learned and wise practical improvers, instead of the more plodding engineers and architects.

C. S. Rafinesque,
Prof. of Hist. and Nat. Sciences.

Ewbank's Patent Tinned Leaden Pipes.—We lately copied from a London paper a notice of a patent taken out in England by Messrs. Warner, for the manufacture of leaden pipes coated with tin. The invention struck us at the time as one of great value, and we have since learned with pleasure that it was made in this city: the Messrs. Warner having purchased the right for England of the inventor, Mr. Thos. Ewbank, of New-York, who has a patent for the United States.

It is well known to persons, who take pains to observe, as well as to the scientific, that leaden pipes are corroded by many of the fluids which pass through them, and that the small portion of acid which it often contains, in the course of time dissolves a perceptible quantity. Beer pipes made of this metal are often found deeply corroded; for the acetate of lead, which is a most poisonous chemical salt, is easily soluble, and is taken off by the fluid which aids in its formation. Mr. Ewbank's pipes are effectually guarded against this source of danger, by being lined

within and without with pure tin. It is of great importance to know also that leaden vessels for culinary use may be protected from the action of acids in the same manner.

Patents, we understand, have been heretofore taken out in England, for coating lead with tin; but the processes rendered the expense too great, and they have been useless. Mr. Ewbank, on the contrary, is able to afford his pipes at a small advance only on the price of those made entirely of lead, which will greatly facilitate their general introduction.

AMBITION.—If there are any dark spots in life upon which we may look back, where the bitter waters of affliction have been mingled in the chalice of joy, their origin may be traced to impure and unbounded passions. I would not gainsay the truth, that reasonable aspirings after honor, or riches, or fame, are not laudable. There is perhaps no feeling of the human heart more interwoven with our natures than the passion of AMBITION. It is the sweet food of our fancy, when we awake in the glowing and halcyon days of our sunny youth—while we are irresistibly led to contemplate life as but a gilded panorama, wherein all bright and beautiful objects are concentrated—when the visions of hope spring up like flowers in the youthful blossom—when no storm is lowering—when no tempest hath gathered. Were it possible that the dreams of our ambition, the one half of our vain yearning for honor or fame, could be fulfilled—then might the aspiring bosom thrill with delight—then might this earth be deemed but another Eden, where the spirit of joy shed its hallowed extacies—where the dark clouds of evil were not permitted to lower—or the fitful and feverish disappointments of life came not in their bitterness to the tranquil spirit.

But, alas! as time bears away on its troubled wave the dim lapses of our faded years, to mingle with the shoreless ocean of eternity, how do the thronging plans of human ambition decay within that breast where they sprung? The dark and sorrowful truth of maturer years is presented in bitter exchange for the gorgeous and over-wrought colorings of the young and enthusiastic soul. It is only experience—that constant prince—that bitter monitor,—which may tell us how futile are many of our fond expectations: and it is not until we have found the garlands of our young existence withered—until we find the tempest clouds of disappointment lowering darkly above and around us, where we had deemed the sun of pleasure poured a flood of glory from the resplendent zenith of his course, that we are forced to exclaim, as we look back upon the bright morning of our childhood, and the shadows and sunshine of our departed existence, that

> "————Years steal
> Fire from the mind as vigor from the limb:
> And life's enchanted cup outsparkles near the brim."

A thousand objects, as we start into life, conspire to fill the soul with the passion of ambition. Who can look forth with the clear and ardent eye of youth upon the flowers with which his future path of life appears to be strewn, and not seek to weave a wreath of their varied and glowing colors? Who can contemplate the star of fame glimmering amidst the clouds that tremble around her dizzy height, and not feel his bosom swell with emotions which he can never express, and yet which he cannot entirely conceal? It is this which causes the proud conqueror to rejoice, as he sits on his triumphal chariot, with the gathered spoils and trophies of nature around him: it is this which thrills the bosom of the philosopher, and fills with the fire of thought the poet's eye.

But it may be reasonably inferred that the thoughts of our own dissolution can never have a place in our bosoms, while they throb with the restless and aspiring emotions of our dawning years. Could this be, how soon would they vanish away, and the musing spirit be brought to ponder on the mutability of all earthly objects. It is DEATH which is the terror and the bitter enemy to impure pleasure and unholy ambition. Its voice is as the sound of many waters—as the great deep which "lifteth up its hands on high;" and it speaks to that ear which is not more deaf than the adder, saying, "all is vanity."

Ask him who turns away in utter hopelessness of his spirit, and the brokenness of his own sorrowful heart, from the grave of one he loved—perchance, a wife, a kind parent, an attractive brother, or an affectionate sister, to whose sympathizing heart he submitted all his sorrow and his joy? Ask him, where is the syren's song of pleasure which beguiled them on earth? Ask him, if the recollection of their buoyancy of spirit brings back the fire of life to the pale and mouldering clay? The convulsive sigh and the bursting tear will be on his mournful reply. Ask the warrior, as he lingers on the

bed of death, what is the tumult of the camp, the glee of the garrison, the clattering of the war-hoof, the deafening clangor of the trumpet, and the din of arms? His hollow voice and struggling accents will exclaim—"They are the viewless wind, and the grave will soon shut out their memory." Ask the man of pleasure, where are the darling visions, the unreal fantasies, which he has pursued from his childhood, and he will tell you that the smiles of realized ambition have been "few and far between;" that his hopes have been unrealized, and his facilities denied. Then will he regret and acknowledge that his brightest hours were all misspent, and the channel of his ambition misdirected. Then will he too deeply feel and express, that although there has been a time with him, when all the kindly affections might have been nurtured in his soul, yet one master passion has driven them from his bosom, and that the frailty of existence had never received a moment's serious weight in his mind. But now the prospect of death has descended deep into his spirit; and the overwhelming reflection has at last overtaken him, that life and its honors are as uncertain as the morning cloud, or "as the vapor which riseth and soon passeth away."

History of Chemistry. [Continued from page 77.]

Phosphorus, when pure, is semi-transparent, and of a yellowish color; but when kept some time in water, it becomes externally opaque, and then has a great resemblance to white wax. Its consistency is nearly that of wax. It may be cut with a knife, or twisted to pieces with the fingers.* It is insoluble in water, but it melts at the temperature of 100°. Its mean specific gravity is 1·770.

Care must be taken to keep phosphorus always under water, particularly when melted; for it is so combustible that it cannot easily be melted in the open air without taking fire. When phosphorus is newly prepared it is always dirty, being mixed with a quantity of charcoal dust, and other impurities. These impurities may be separated by melting it under water, and then squeezing it through a piece of clean chamois leather. It may be formed into sticks, by putting it into a glass funnel with a long tube, stopped at the bottom with a cork, and plunging the whole under warm water. The phosphorus melts, and assumes the shape of the tube. When cold, it may be easily pushed out with a bit of wood.

If air be excluded, phosphorus evaporates at 219°, and boils at 554°.

When phosphorus is exposed to the atmosphere it emits a white smoke, which has the smell of garlic, and is luminous in the dark. This smoke is more abundant the higher the temperature is, and is occasioned by the gradual combustion of the phosphorus, which at last disappears altogether.

When a bit of phosphorus is put into a glass jar filled with oxygen gas, part of the phosphorus is dissolved by the gas at the temperature of 60°; but the phosphorus does not become luminous unless its temperature be raised to 80°. Hence we learn that phosphorus burns at a lower temperature in common air than in oxygen gas. This slow combustion of phosphorus, at the common temperature of the atmosphere, is what renders it necessary to be kept in phials filled with water. The water should be previously boiled, to expel a little air which that liquor usually contains. The phials should be kept in a dark place; for when phosphorus is exposed to the light it soon becomes of a white color, which gradually changes to a dark brown.

When heated to 148°, phosphorus takes fire and burns with a very bright flame, and gives out a great quantity of white smoke, which is highly luminous in the dark. It leaves no residuum; but the white smoke, when collected, is found to be an *acid*. Stahl considered this acid as the muriatic.* According to him, phosphorus is composed of muriatic acid and phlogiston,† and the combustion of it is merely the separation of phlogiston. He even declared, that, to make phosphorus, nothing more is necessary than to combine muriatic acid and phlogiston.

These assertions having gained implicit credit, the composition and nature of phosphorus were considered as completely understood, till Margraf of Berlin published his experiments in the year 1740. That great man, one of those illustrious philosophers who have contributed so much to the rapid increase of the science, distinguished equally by the ingenuity of his experiments and clearness of his reasoning, attempted to pro-

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* This being rather a dangerous operation, water ought to be at hand to plunge it into as soon as it begins to smoke.

* This acid will be afterwards described.

† The term *phlogiston* was applied by Stahl and his followers to a substance, which, according to them, exists in all combustible bodies, and separates during combustion.

duce phosphorus by combining together phlogiston and muriatic acid: but though he varied his process a thousand ways, presented the acid in many different states, and employed a variety of substances to furnish phlogiston, all his attempts failed, and he was obliged to give up the combination as impracticable. On examining the acid produced during the combustion of phosphorus, he found that its properties were very different from those of muriatic acid. It was therefore a distinct substance. The name of *phosphoric acid* was given to it; and it was concluded that phosphorus is composed of this acid united to phlogiston.

But it was observed by Margraf, that phosphoric acid is heavier than the phosphorus from which it was produced; and Boyle had long before shown that phosphorus would not burn, except when in contact with air. These facts were sufficient to prove the inaccuracy of the theory concerning the composition of phosphorus; but they remained themselves unaccounted for, till Lavoisier published those celebrated experiments which threw so much light on the nature and composition of acids.

He exhausted a glass globe of air, by means of an air-pump, and after weighing it accurately, he filled it with oxygen gas, and introduced into it 100 grains of phosphorus. The globe was furnished with a stop-cock, by which oxygen gas could be admitted at pleasure. He set fire to the phosphorus by means of a burning-glass. The combustion was extremely rapid, accompanied by a bright flame and much heat. Large quantities of white flakes attached themselves to the inner surface of the globe, and rendered it opaque; and these at last became so abundant, that, notwithstanding the constant supply of oxygen gas, the phosphorus was extinguished. The globe, after being allowed to cool, was again weighed before it was opened. The quantity of oxygen employed during the experiment was ascertained, and the phosphorus which still remained unchanged accurately weighed. The white flakes, which were nothing else than pure phosphoric acid, were found exactly equal to the weights of the phosphorus and oxygen which had disappeared during the process. Phosphoric acid, therefore, must have been formed by the combination of these two bodies; for the absolute weight of all the substances together was the same after the process as before it. It is impossible, then, for phosphorus to be composed of phosphoric acid and phlogiston, as phosphorus itself enters into the composition of that acid.

Thus the combustion of phosphorus, like that of hydrogen and carbon, is nothing else than its combination with oxygen: for during the process no new substance appears, except the acid, accompanied indeed with much heat and light.

From Lavoisier's experiment it follows, that 100 parts of phosphorus, during this combustion, unite with 154 parts of oxygen. So that a grain of phosphorus condenses no less than $4\frac{1}{2}$ cubic inches of oxygen gas; and five grains are capable of depriving $102\frac{1}{4}$ cubic inches of air of all its oxygen gas.

Though pure phosphorus does not take fire till it be heated to 148°, it is nevertheless true that we meet with phosphorus which burns at much lower temperatures. The heat of the hand often makes it burn vividly, and it even takes fire when merely exposed to the atmosphere. In all these cases the phosphorus has undergone a change. It is believed at present, that this increase of combustibility is owing to a small quantity of oxygen with which the phosphorus has combined. Hence, in this state, it is distinguished by the name of *oxide of phosphorus*. When a little phosphorus is exposed in a long narrow glass tube to the heat of boiling water, it continues moderately luminous, and gradually rises up in the state of a white vapor, which lines the tubes. This vapor is the *oxide* of phosphorus. This oxide has the appearance of fine white flakes, which cohere together, and is more bulky than the original phosphorus. When slightly heated it takes fire, and burns brilliantly. Exposed to the air, it attracts moisture with avidity, and is converted into an acid liquor. When a little phosphorus is thus oxidized in a small tin box by heating it, the oxide acquires the property of taking fire when exposed to the air. In this state it is often used to light candles, under the name of *phosphoric matches:* the phosphorus being sometimes mixed with a little oil, sometimes with sulphur. But the simplest mode of making matches of this kind is to put a little phosphorus, dried by blotting-paper, into a small phial; to heat the phial; and when the phosphorus is melted, to turn it round, so that the phosphorus may adhere to the sides. The phial is then to be closely corked and prepared for use. On putting a common sulphur match into the bottle, and stirring it about, the phosphorus will adhere to the match, and will take fire when brought out into the air.

When bits of phosphorus are kept for some hours in hydrogen gas, part of the phosphorus is dissolved. This compound gas, to which Fourcroy and Vauquelin, the discoverers of it, have given the name of *phosphorized hydrogen gas*, has a slight smell of garlic. When bubbles of it are made to pass into oxygen gas, a very brilliant bluish flame is produced, which pervades the whole vessel of oxygen gas. It is obvious that this flame is the consequence of the combustion of the dissolved phosphorus.

When phosphorus is introduced into a glass jar of hydrogen gas standing over mercury, and then melted by means of a burning glass, the hydrogen gas dissolves a much greater proportion of it. The compound thus formed has received the name of *phosphuretted hydrogen gas*. It was discovered in 1783, by Mr. Gengembre, and afterwards by Mr. Kirwan, before he knew of the experiments of Gengembre.

It has a very fetid odor, similar to the smell of putrid fish. When it comes into contact with common air, it burns with great rapidity; and if mixed with that air, detonates violently. Oxygen gas produces a still more rapid and brilliant combustion than common air. When bubbles of it are made to pass up through water, they explode in succession as they reach the surface of the liquid; a beautiful coronet of white smoke is formed, which rises slowly to the ceiling. This gas is the most combustible substance *known*.

Pure water, when agitated in contact with this gas, dissolves at the temperature of betwen 50 and 60° about the fourth part of its bulk of it.* The solution is of a color not unlike that of roll sulphur; it has a very bitter and disagreeable taste, and a strong unpleasant odor. When heated nearly to boiling, the whole of the phosphuretted hydrogen gas is driven off unchanged, and the water remains behind in a state of purity. When exposed to the air, the phosphorus is gradually deposited in the state of oxide; the hydrogen gas makes its escape; and at last nothing remains but pure water.

When electric explosions are passed through this gas, its bulk is increased precisely as happens to carburetted hydrogen. The water which it contains is decomposed, phosphoric acid formed, and hydrogen gas evolved.

* Mr. Henry, however, found that 100 inches of water took up only 2 14 inches of this gas at the temperature of 60 degrees.

Phosphorus is capable of combining with carbon. This compound, which has received the name of *phosphuret of carbon*,* was first examined by Mr. Proust, the celebrated professor of chemistry in Spain. It is the red substance which remains behind when new-made phosphorus is strained through chamois leather. In order to separate from it a small quantity of phosphorus which it contains in excess, it should be put into a retort and exposed for some time to a moderate heat. What remains behind in the retort is the pure phosphuret of carbon. It is a light flocky powder of a lively orange red, without taste or smell. When heated in the open air it burns rapidly, and a quantity of charcoal remains behind. When the retort in which it is formed is heated red hot, the phosphorus comes over, and the charcoal remains behind.

Such are the properties of phosphorus, and the compounds which it forms with oxygen, hydrogen, and carbon. It is capable, likewise, of combining with many other bodies: the compounds produced are called *phosphurets*.

Phosphorus, when used internally, is poisonous, even in so small a quantity as one-fourth of a grain.

Of Sulphur.†—Sulphur is a simple combustible body like the preceding, and the fourth in the order of affinity for oxygen. It is the most easily procured, in a state of purity, of all the simple combustibles, and often found in that state in nature, particularly in the neighborhood of volcanoes.

It is also procured in large quantities from the mineral substance called *Pyrites*, by distillation.

Sulphur was the first known of all the combustibles, and was long considered as the general cause of combustibility.

Though very anciently known, sulphur has also been long the source of errors and strange hypotheses in chemistry. It was on this substance that Stahl founded his theory of phlogiston, which governed the schools for more than a century.

Since the establishment of the pneumatic doctrine, the facts have been accurately observed and much better examined, and the phenomena presented by sulphur have proved that it has not been decomposed; that it only obeys the laws of composition, and is acted upon, in this respect, like phos-

* See note, page 74.

† Sulphur is also known by the name of *brimstone*

phorus, carbon, the metals, &c. In general, sulphur has been at all times one of those substances which have participated the most in the different changes which the science has experienced, and concerning which philosophers have been more particularly employed.

Sulphur is consequently a body whose combinations are the most numerous, and at present the best understood.

1. Sulphur is a hard brittle substance, commonly of a yellow color, without any smell, and of a weak though perceptible taste.

It is a non-conductor of electricity, and of course becomes electric by friction. Its specific gravity is 1·990.

Sulphur undergoes no change by being allowed to remain exposed to the open air. When thrown into water it does not melt as common salt does, but falls to the bottom and remains there unchanged: it is therefore insoluble in water.

2. If a considerable piece of sulphur be exposed to a sudden though gentle heat, by holding it in the hand, for instance, it breaks to pieces with a crackling noise.

When sulphur is heated to the temperature of about 170°, it rises up in the form of a fine powder, which may be easily collected in a proper vessel. This powder is called *flowers of sulphur*.* When substances fly off in this manner on the application of a moderate heat, they are called *volatile;* and the process itself by which they are raised is called *volatilization.*

When heated to the temperature of about 214° of Fahrenheit's thermometer, it melts and becomes as liquid as water. If this experiment be made in a thin glass vessel, like the annexed figure, the vessel may be placed upon burning coals, without much risk of breaking it. The strong heat soon causes the sulphur to boil, and converts it into a brown colored vapor, which fills the vessel, and issues with considerable force out from its mouth.

3. There are a great many bodies which, after being dissolved in water, or melted by heat, are capable of assuming certain regular figures. If a quantity of common salt, for instance, be dissolved in water, and that fluid, by the application of a moderate heat, be made to fly off in the form of steam, or, in other words, if the water be slowly *evaporated*, the salt will fall to the bottom of the vessel in cubes. These regular figures are called *crystals.* Now sulphur is capable of crystalizing. If it be melted, and as soon as its surface begins to congeal, the liquid sulphur beneath be poured out, the internal cavity will exhibit long needle-shaped crystals of an octahedral figure. This method of crystalizing sulphur was contrived by Rouelle. If the experiment be made in a glass vessel, or upon a flat plate of iron, the crystals will be perceived beginning to shoot when the temperature sinks to about 220°.

When sulphur is heated to the temperature of 560° in the open air, it takes fire spontaneously, and burns with a pale blue flame, and at the same time emits a great quantity of fumes of a very strong, suffocating odor. When set on fire and then plunged into a jar full of oxygen gas, it burns with a bright violet colored flame, and at the same time emits a vast quantity of fumes. If the heat be continued long enough, the sulphur burns all away, without leaving any ashes or *residuum.* If the fumes be collected, they are found to consist entirely of *sulphuric acid.* By combustion, then, sulphur is converted into an acid.* This fact was known several centuries ago; but no intelligible explanation was given of it till the time of Stahl, who founded the theory already alluded to upon the experiments he made on this subject.

There are two facts, however, which Stahl either did not know, or did not sufficiently attend to, neither of which was accounted for by his theory. The first is that sulphur will not burn if air be completely excluded; the second, that sulphuric acid is heavier than the sulphur from which it was produced.

To account for these, or facts similar to these, succeeding chemists refined upon the theory of Stahl, deprived his phlogiston of *gravity*, and even assigned it a principle of *levity.* Still, however, the necessity of the contact of air remained unexplained. At last Mr. Lavoisier, who had already distinguished himself by the extensiveness of his views, the accuracy of his experiments, and the precision of his reasoning, undertook the examination of this subject, and his experiments were published in the memoirs of the Academy of Sciences for 1777. He

* It is only in this state that sulphur is to be found in commerce tolerably pure. *Roll sulphur* usually contains a considerable portion of foreign bodies.

* Acids are a class of compound bodies, which will be afterwards described.

put a quantity of sulphur into a large vessel filled with air, which he inverted into another vessel containing mercury, and then set fire to the sulphur by means of a burning glass. It emitted a blue flame, accompanied with thick vapors, but was very soon extinguished, and could not be again kindled. There was, however, a little sulphuric acid formed, which was a good deal heavier than the sulphur which had disappeared; there was also a diminution in the air of the vessel proportional to this increase of weight. The sulphur, therefore, during its conversion into an acid, must have absorbed part of the air. He then put a quantity of sulphuret of iron, which consists of sulphur and iron combined together, into a glass vessel full of air, which he inverted over water.* The quantity of air in the vessel continued diminishing for eighteen days, as was evident from the ascent of the water to occupy the space which it had left; but after that period no further diminution took place. On examining the sulphuret, it was found somewhat heavier than when first introduced into the vessel, and the air of the vessel wanted precisely the same weight. Now this air had lost all its oxygen; consequently the whole of that oxygen must have entered into the sulphuret. Part of the sulphur was converted into sulphuric acid; and as all the rest of the sulphuret was unchanged, the whole of the increase of weight must have been owing to something which had entered into that part of the sulphur which was converted into acid. This something we know was oxygen. Sulphuric acid, therefore, must be composed of sulphur and oxygen; for as the original weight of the whole contents of the vessel remained exactly the same, there was not the smallest reason to suppose that any substance had left the sulphur.

The combustion of sulphur, then, is nothing else than the act of its combination with oxygen; and, for any thing which we know to the contrary, it is a simple substance.

From the slow combustibility of sulphur, and the difficulty of condensing the acid fumes, it was not possible for Lavoisier to ascertain with how much it unites during its combustion in oxygen gas; but it may be converted into sulphuric acid by boiling it in a quantity of *nitric acid*† : and the proportion of oxygen with which it has united may be deduced from the increase of its weight. This experiment was first tried by Berthollet, but his apparatus did not enable him to attain precision. Thenard and Chenevix repeated it, and with proper precautions. According to the first, 100 parts of sulphur unite with 80; according to the last, with 62·6 of oxygen; the mean of both gives us 71·3 of oxygen. If we consider it as nearly correct, then 100 grains of sulphur unite, during combustion, with nearly 209 cubic inches of oxygen gas; and one grain of sulphur is capable of depriving 9½ inches of common air of all its oxygen.

4. But sulphur does not always unite with so great a quantity of oxygen: indeed, it usually burns with a blue flame, and emits an exceedingly offensive smell. This smell is occasioned by the escape of a gas, which may be confined in proper vessels: it is *sulphurous acid*. By adding oxygen to it we may convert it into sulphuric acid: a proof that it contains less oxygen than that acid.

5. If sulphur be kept melted in an open vessel, it becomes gradually thick and viscid. When in this state, if it be poured into a basin of water, it will be found to be of a red color, and as soft as wax. In this state it is employed to take off impressions from seals and medals. These casts are known in this country by the name of *sulphurs*. When exposed to the air for a few days, the sulphur soon recovers its original brittleness, but it retains its red color. It is supposed at present, that sulphur, rendered viscid and red by a long fusion, has combined with a little oxygen; hence the term *oxide of sulphur* has been applied to it. This substance, when newly made, has a violet color; it has a fibrous texture; its specific gravity is 2·3; it is tough, and has a straw color when pounded. Dr. Thomson found that 100 parts of it, when converted into sulphuric acid by means of nitric acid, became 160 parts, and therefore had united with 60 parts of oxygen.

6. When sulphur is first obtained by precipitation from any liquid that holds it in solution, it is always of a white color, which gradually changes to greenish yellow when the sulphur is exposed to the open air. If this white powder, or *lac sulphuris*, as it is called, be exposed to a low heat in a retort, it soon acquires the color of common sulphur; and, at the same time, a quantity of water is deposited in the beak of the retort. On the other hand, when a little water is dropped into melted sulphur, the portion in

* This experiment was first made by Scheele, but with a different view.

† This acid, called in common language *aqua fortis*, will be described hereafter.

contact with the water immediately assumes the white color of *lac sulphuris*. If common sulphur be sublimed into a vessel filled with the vapor of water, we obtain *lac sulphuris* of the usual whiteness, instead of the common flowers of sulphur. These facts prove that *lac sulphuris* is a compound of sulphur and water. Hence we may conclude, that greenish yellow is the natural color of sulphur. Whiteness indicates the presence of water.

7. Sulphur unites very readily to hydrogen, and forms a compound known by the name of *sulphuretted hydrogen gas;* but this will be afterwards noticed in treating of the gases.

Till lately it was supposed that sulphur does not combine with *carbon;* but Messrs. Clement and Desormes, two French chemists, have discovered that they may be made to combine; and that when this is the case, the compound assumes the form of a liquid, to which has been given the name of *carburet* of sulphur.

This liquid is transparent, and colorless when pure, but very frequently it has a greenish yellow tinge. Its taste is cooling and pungent, and its odor strong and peculiar. Its specific gravity is 1·35. It does not mix with water. When put into the receiver of an air pump, and the air exhausted, it rises in bubbles through the water, and assumes the form of a gas. The same change takes place when it is introduced to the top of a barometer tube; but it is again condensed into a liquid when the tube is immersed under mercury.

This compound burns easily, like spirit of wine, and many other liquids. During the combustion it emits a sulphurous odor; sulphur is deposited, and charcoal remains behind. When a little of it is put into a bottle filled with oxygen gas, it gradually mixes with the oxygen, and assumes the gaseous form. If a burning taper be applied to the mouth of the bottle, the mixture burns instantaneously, and with an explosion so violent as to endanger the vessel. It assumes the gaseous form in the same way when placed in contact with air. It does not detonate when kindled, but burns quietly.

This liquid dissolves phosphorus readily. It also dissolves a small portion of sulphur; but has no action whatever on charcoal.

Sulphur combines with phosphorus very readily.

All that is necessary to effect this is to mix the two substances together, and apply a degree of heat sufficient to melt them. The compound has a yellowish white color, and a crystalized appearance. The combination may also be obtained by heating the mixture in a glass tube, having its mouth properly secured from the air. The sulphuret of phosphorus, thus prepared, is more combustible than phosphorus. If it be set on fire by means of a hot wire, allowed to burn for a little, and then extinguished by excluding the air, the phosphorus, and perhaps the sulphur, is oxidized, and the mixture acquires the property of taking fire spontaneously as soon as it comes in contact with air.

The combination may likewise be effected by putting the two bodies into a retort, or flask, filled with water, and applying heat cautiously and slowly. They combine together gradually as soon as the phosphorus is melted. It is however necessary to apply the heat cautiously, because the sulphuret of phosphorus has the property of decomposing water. The rate of decomposition increases very rapidly with the temperature, a portion of the two combustibles being converted into acids by uniting with the oxygen: the hydrogen at the moment of its evolution unites with sulphur and phosphorus, and forms sulphuretted and phospuretted gases. This evolution, at the boiling temperature, is so rapid as to occasion violent explosions. The circumstances attending this explosion have been examined, and it has been found that the gas emitted burns spontaneously, and leaves phosphoric and sulphuric acids. The sulphuret of phosphorus formed under *water* has a yellow color. It gives to the water in which it is kept an acid taste, and the smell of sulphuretted hydrogen. It burns, according to Mr. Briggs, at a temperature considerably lower than a similar compound made in the dry way. This induces him to conclude that during the combination a little water is decomposed, and the oxygen expended in converting the sulphur and phosphorus into oxides.

This compound was particularly examined by Pelletier, and found to congeal at different temperatures, according to the proportion in which the sulphur and phosphorus are combined. When the sulphur predominates, the compound is called *phosphuret* of *sulphur;* and when the phosphorus predominates, it is called *sulphuret* of *phosphorus.*

Azote, or Nitrogen.*—Azote, or nitro-

* Nitrogen was the name given to this gas by the

gen is a simple body in the same condition with respect to us as oxygen, with which it has a very strong tendency to combine. It cannot be procured perfectly pure. It is always either combined with caloric in the form of a gas, or exists in a liquid or solid state in certain natural and artificial compounds, from which chemists procure it in the state of gas. If it exists alone, either in the solid or liquid form in nature, it has hitherto eluded the researches of chemists.

Like oxygen, azote remained for a long time unknown. It was discovered in 1772 by the late Dr. Rutherford, Professor of Botany in the University of Edinburgh.

It has since been procured by Scheel, Berthollet, and Lavoisier, by very different processes.

That by which Scheel procured it was the following: He mixed about equal weights of iron filings and sulphur into a paste with water, and placed the mixture in a proper vessel, over water supported on a stand; he then put an inverted glass jar full of *atmospherical* air over it, and allowed this to stand exposed to the mixture two or three days.

He perceived by the ascent of the water, that the air in the jar gradually diminished in bulk, but at the end of the third day the water ceased to rise in the jar: he therefore examined the air which remained in the jar, and found it to be azotic gas.

Lavoisier's method of procuring it is much quicker. He decomposed atmospherical air by burning phosphorus in a vessel containing a given quantity of it.

The readiest way of procuring it is, therefore, to put a small piece of phosphorus into a tea-cup raised on a stand above the surface of the water contained in the pneumatic trough, then to set fire to the phosphorus, and quickly invert a jar over it filled with atmospherical air. As soon as the combustion ceases, the jar will appear to be about three-fourths full of air of a very white color, which, upon standing a short time over the water, will become perfectly transparent. This air is azotic or nitrogen gas, tolerably pure.

There are other methods of procuring it, but the following process, first pointed out by Berthollet, furnishes it nearly *pure*, if the proper precautions be attended to. Very much diluted *nitre acid* (*aqua-fortis*) is poured upon a piece of muscular flesh, in a retort, and a heat of about 100 degrees applied to it. A considerable quantity of azotic gas is then produced, which may be received into proper vessels placed on the shelf of the pneumatic trough.

1. The air of the atmosphere contains about 0·78 parts (in bulk) of azotic gas; almost all the rest of it is oxygen gas. Mr. Lavoisier was the first philosopher who published this analysis, and who made azotic gas known as a component part of air. His experiments were published in 1773.

2. Azotic gas is invisible and elastic like common air, which it resembles in its mechanical properties. It has no smell. Its specific gravity, according to Kirwan, is 0·985, that of air being 1·000. Lavoisier makes it only 0·978, and with this the statement of Sir H. Davy coincides exactly. According to Mr. Kirwan, 100 cubic inches of it, at the temperature of 60°, barometer 30 inches, weigh 30·535 grains; according to Lavoisier and Davy, they weigh 30·338 grains.

3. It cannot be breathed by animals without suffocation. If obliged to respire it, they drop down dead almost instantly.* No combustible will burn in it. Hence the reason why a candle is extinguished in atmospherical air as soon as the oxygen near it is consumed. Mr. Goettling published in 1794 that phosphorus shone, and was converted into phosphoric acid, in pure azotic gas. Were this the case it would not be true that no combustible will burn in this gas; for the conversion of phosphorus into an acid, and even its shining, is an actual though slow combustion. Mr Goettling's experiments were soon after repeated by Drs. Scherer and Jaeger, who found that phosphorus does not shine in azotic gas when it is perfectly pure; and that therefore the gas on which Mr. Goettling's experiments were made had contained a mixture of oxygen gas, owing principally to its having been confined only by water. These results were afterwards confirmed by Professor Lampadius, and Professor Hildebrandt. It is therefore proved beyond a doubt, that phosphorus does not burn in azotic gas; and that whenever it appears to do so, there is always some oxygen gas present.

4. This gas is not sensibly absorbed by water; nor indeed are we acquainted with any liquid which has the property of condensing it. Mr. Henry ascertained, that

French chemists, at the framing of the new nomenclature; but in this country it usually receives the name of azote or azotic gas.

* Hence the name *azote*, given it by the French chemists, which signifies "destructive to life."

when water is previously deprived of all the air which it contains, 100 inches of it are capable of absorbing only 1·47 inches of azotic gas at the temperature of 60°.

When electric sparks are made to pass through common air confined in a small glass tube, or through a mixture of oxygen gas and azotic gas, the bulk of the air diminishes. This curious experiment was first made by Dr. Priestley, who ascertained at the same time, that if a little of the blue infusion of *litmus* be let up into the tube, it acquires a red color; hence it follows that an acid is generated. Mr. Cavendish ascertained that the diminution depends upon the proportion of oxygen and azote present; that when the two gases are mixed in the proper proportions, they disappear altogether, being converted into *nitric acid*. Hence he inferred that nitric acid is formed by the combination of these two bodies. This important discovery was communicated to the Royal Society on the 2d June, 1785. The combination of the gases, and the formation of the acid, was much facilitated, he found, by introducing into the tube a solution of *potash* in water. This body united with the nitric acid as it was produced, and formed with it the salt called *nitre*. In Mr. Cavendish's first experiments there was some uncertainty, both in the proportion of oxygen gas and of common air, which produced the greatest diminution in a given time, and in the proportion of the two gases which disappeared by the action of the electricity. The experiment was twice repeated in the winter 1787–8 by Mr. Gilpin, under the inspection of Mr. Cavendish, and in the presence of several members of the Royal Society.

2. Nitric acid, which will be more fully described in another part of this work, is a heavy liquid, usually of a yellow color, which acts with great energy upon most substances, chiefly in consequence of the facility with which it yields a portion of its oxygen. If a little phosphorus or sulphur, for instance, be put into it, the acid when a little heated gives up oxygen to them, and converts them into acids precisely as if the two bodies were subjected to combustion. In this case, the nitric acid, by losing a portion of its oxygen, is changed into a species of gas called *nitrous gas*, which flies off and occasions the effervescence which attends the action of nitric acid on these simple combustibles. Nitrous gas is procured in greater abundance, as well as purity, by dissolving copper or silver in nitric acid. The gas may be received in a water trough in the usual way. It possesses the curious property of combining with oxygen the instant it comes in contact with it, and of forming nitric acid. Hence the yellow fumes which appear when nitrous gas is mixed with common air. This combination furnishes a sufficient proof, that the constituents of nitrous gas are azote and oxygen, and that it contains less oxygen than nitric acid. It is, therefore, considered as an *oxide of azote*.

3. When iron filings are kept for some days in nitrous gas, they deprive it of a portion of its oxygen, and convert it into a gas, which no longer becomes yellow when mixed with common air, but in which phosphorus burns with great splendor, and is converted into phosphoric acid. This combustion and acidification is a proof that the new gas contains oxygen. Its formation demonstrates that it contains azote, and that it has less oxygen than nitrous gas. It is therefore an *oxide of azote* as well as nitrous gas. The name *gaseous oxide of azote* has been given to it.

Thus we find that azote is capable of uniting with three doses of oxygen, and of forming two oxides and one acid. We shall find afterwards that there is still another acid composed of the same ingredients.

The combinations of azote with simple combustibles are scarcely so numerous; but some of them are of great importance.

1. When putrid urine, wool, shavings of horn, and many other animal substances, are subjected to distillation, among other products, there is obtained a substance which has a very pungent odor, and which is well known under the names of *hartshorn* and *volatile alkali*.* It may be procured in greatest purity from the salt called *sal ammoniac*. Pound this salt and put it into a flask, together with thrice its weight of ground quicklime, and luting on a bent tube, plunge the extremity of it into a mercurial trough, and apply heat to the flask. A gas comes over, which is *hartshorn* in a state of purity; by chemists it is usually called *ammoniac*. It is light, absorbed in great abundance by water, has a pungent taste, and gives a green color to vegetable blues. When electric sparks are passed through this gas, its bulk is doubled, and it is converted into a mixture of hydrogen and azotic gases. This is a de-

* The term *alkali* is applied in chemistry to a variety of substances which have the property of giving a green color to vegetable blues.

monstration of its composition.* But it is difficult to form ammonia by uniting its two elements artificially. However, Dr. Austin succeeded in combining them. When both are in the gaseous state, the union does not take place; but when hydrogen, at the instant of its evolution, comes in contact with azotic gas, ammonia is formed. Dr. Austin filled a jar with azotic gas, placed it over mercury, and let up into it some moistened iron filings. Now iron filings have the property of decomposing water. They unite with its oxygen, and allow its hydrogen to escape. There was suspended in the jar a paper tinged blue with radish. In a day or two it became green, and thus indicated the formation of ammonia; for no gas but ammonia has the property of changing vegetable blues to green. When nitrous gas was substituted for azote, the ammonia was evolved more speedily. The experiment succeeded also with common air, but more slowly.

2. No compound of azote and carbon is at present known; but, according to Fourcroy, azotic gas has the property of dissolving a little charcoal. For, he says, azotic gas, obtained from animal substances by Berthollet's process, when confined long in jars, deposits on the sides of them a black matter, which has the properties of charcoal.

3. Phosphorus plunged into azotic gas is dissolved in a small proportion. Its bulk is increased about $\frac{1}{20}$, and *phosphuretted azotic gas* is the result, which, if mixed with oxygen gas, becomes luminous, in consequence of the combustion of the dissolved phosphorus.

4. Fourcroy informs us, that when sulphur is melted in azotic gas, part of it is dissolved, and *sulphuretted azotic gas* formed.

As azote has never yet been decompounded, it must, in the present state of our knowledge, be considered as a simple substance. Dr. Priestley, who obtained azotic gas at a very early period of his experiments, considered it as a compound of oxygen gas and phlogiston, and for that reason gave it the name of *phlogisticated* air. Stahl considered combustion as merely the separation of phlogiston from the burning body. But as these theories are now abandoned, and as all the attempts to decompose azote have hitherto failed, we must of necessity consider it as a simple substance. It must be acknowledged, however, that there are several chemical phenomena altogether inexplicable at present; but which might be accounted for if it were possible to prove that azote is a compound, and that one of the component parts of water enters into its composition. One of these phenomena is the formation of RAIN: another is the constant disengagement of azotic gas when ice is melted. Dr. Priestley found, that when water, previously freed from air as completely as possible, is frozen, it emits, when melted again, a quantity of azotic gas. He froze the same water nine times without exposing it to the contact of air, and every time obtained nearly the same proportion of azotic gas.

* This gas was first analyzed by Scheele, but the proportions were accurately ascertained by Berthollet and Austin.

Chloride of Lime and Pulmonary Complaints.

[From the New-England Farmer.]

The following communication and certificate annexed afford a fair promise of a specific against one of the most formidable and obstinate of all the diseases to which mankind are liable.

MR. EDITOR—I hope you will not think me guilty of flattery when I speak of the value to myself and the public of your interesting Journal. You publish experiments upon the human system of gentlemen of high respectability, as well as essays, &c. on agriculture. On reading the experiments so very interesting in pulmonary complaints by Dr. Cotteren in Paris, France, on patients afflicted with consumption, I ventured to try the experiment of inhaling the gaseous perfume of chlorate of lime on a young man, a nephew to my wife, whose certificate accompanies this communication, and which I took myself, after his health had so improved as to visit me, (a ride of five miles.) He is about twenty-five years of age, of steady habits, and industrious. I visited him after he had been sick 5 or 6 weeks, and thought him not so sick as I expected to find him, although much reduced. I returned home in hopes I should hear he was better, but every day brought tidings of his growing worse. A second physician was called, a gentleman of eminence in his profession: I saw him, who informed me he feared his case was doubtful. Some of my family visited him, the answer was he grew worse, was wasting very fast, and according to human view was rapidly approaching the close of life. All this time the article above alluded to never entered my mind, till the young man was in the last stages of a consumption. One Sabbath evening, after retiring, not having much inclination to sleep, I was thinking of this distressed family:

Dr. Cotteren's experiment darted into my mind. The next morning I spoke of it in my family—my oldest son (who had witnessed the surprising effect which chloride of lime had upon the corpse of a young man who had been dead four days, and brought almost sixty miles in a waggon over a rough road in a new country, one year ago in June last,) was very urgent for the application to his cousin. It was procured by sending four miles; my son went with it, and administered it, watching through the night. Neither of us possessing any medical knowledge, I advised him to use it with caution, and at first there was no apparatus used. Some was prepared by putting a quarter of a pound into a junk bottle, filling the bottle with soft water, shaking it a little, letting it stand till settled, pouring it into a saucer, and to a gill adding half as much vinegar, when it is then fit for use. The saucer was placed near the bed; finding no unpleasant sensations it was put near to his mouth and nose, advising the sick man to shut his mouth and inhale the fumes through the proper orifice to the lungs. A free use was made of it all the night; the liquid in a vessel was rather inconvenient, a rag was wet: he said he received it stronger from the rag than any other way. My son left him in the morning more comfortable than he had been for several days. The use of it was continued, and the sick man's health improved, to the astonishment of all who saw him. The above, together with the certificate, are the facts as they took place; and the young man's health has improved so much in the short space of time, that he is able to transact business, and do some labor every day, at the date of this communication.

I hope that a further trial will be made by those afflicted with disordered lungs and the result published, as the ingredient is so cheap, and the application so simple and easy, and it is obtainable by every person in every situation of life. I hope that this case may be published in every Journal, as there was no other medicine used and the effect was so salutary. Yours, respectfully,

JAMES WALKER.

Fryeburg, Me., Aug. 3, 1833.

[*Certificate.*]—I hereby certify that I was taken sick the sixth day of April, 1833, with an inflammatory fever, as my physician called it. My complaint was a pain in the left side, in the greatest extreme, which caused an inflammation on my lungs, which, of course, ulcerated, attended with a distressing cough, which brought up the matter that had suppurated upon my lungs in such quantities that I was almost strangled by the discharge. I was sick nearly three months; was so much reduced that I could not sit in a chair without being supported by one person, while another made my bed. I called a second physician, who met my former doctor; they examined my case and considered it doubtful. I followed the direction of both the gentlemen, but my lungs were so diseased that I grew worse every day. My case was now considered hopeless. My doctor told me he could do no more for me. At this stage of my disorder I was advised by my uncle Walker to inhale the fume of chloride of lime, which I did, and received immediate relief. About the 25th of June, when I was at the lowest, some days I brought up more than two quarts of matter from my lungs in the course of 24 hours; but after inhaling the fume of the lime a short space my cough abated, and I ceased to bring up the matter from my lungs as I had done before. I never brought up any but once after inhaling the lime; my health improved much faster than I could expect. In six days I could walk about the room; the ninth I walked out of doors; the twelfth I rode a mile on horseback, and now my health is fast improving. I made use of no other kind of medicine whatever.

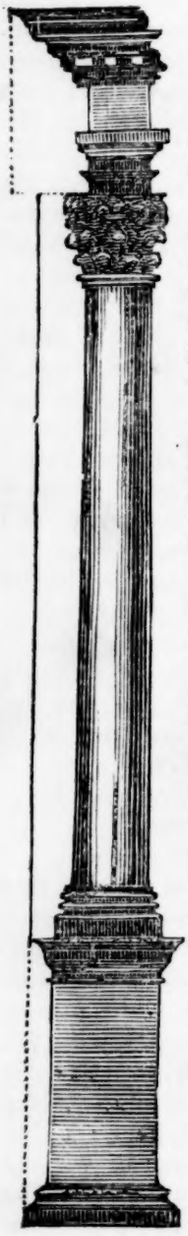
CALEB WARREN, JR.

Denmark, Me., July 13, 1833.

UGLINESS.—It is curious to observe that an ugly face is generally the indication of a humorous and witty mind; it suggests innumerable exhilarating witticisms in the wearer himself, and is the cause of wit to others. There is scarcely a merry, shrewd, witty fellow, even in fictitious history, but has the honor of ugliness attributed to him. Æsop was a very ugly little hunch-back; uglier still was Socrates, no less a man of wit and a man of humor than a philosopher. The heroes of Rabelais were famous for personal deformity. Sancho Panza, his master, and Rosinante, were in their several conditions absolutely patterns of this interesting qualification. Hudibras and Ralpho were still more conspicuously ugly. Falstaff, Bardolph, ancient Pistol, and almost every character of wit and humor in the dramas of Shakspeare, were eminently ugly. Scarron, the favorite wit of France, was the most deformed little creature a lovely woman ever allowed herself to be coupled to.

Of the Orders of Architecture. [Continued from page 96.]

COMPOSITE ORDER.—The Composite Order is the last of the five orders of columns: so called because its capital is *composed* out of those of the other orders.



It borrows a quarter round from the Tuscan and Doric; a double row of leaves from the Corinthian; and volutes from the Ionic: its cornice has simple modillions, or dentils.

The *composite* is also called the *Roman* and *Italian* order, as having been invented by the Romans; conformably to the rest, which are denominated from the people among whom they had their rise.

Most authors rank this after the Corinthian, either as being the richest, or as the last that was invented: Scamozzi alone places it between the Ionic and Corinthian, out of a view to its delicacy and richness, which he esteems inferior to that of the Corinthian; and, therefore, makes no scruple to use it under the Corinthian, wherein he is followed by M. le Clerc. The proportions of this order are not fixed by Vitruvius; he only marks its general character, by observing, that its capital is composed of several parts taken from the Doric, Ionic, and Corinthian: he does not seem to regard it as a particular order; nor does he vary it at all from the Corinthian, except in its capital. In effect, it was Serlio who first added the *composite* order to the four of Vitruvius, forming it from the remains of the temple of Bacchus, the arches of Titus, Septimus, and the Goldsmiths, at Rome: till then, this order was esteemed a species of the Corinthian, only differing in its capital.

The order being thus left undetermined by the ancients, the moderns have a kind of right to differ about its proportions, &c. Scamozzi, and after him M. le Clerc, make its column 19 modules and a half; which is less by half a module than the Corinthian. Vignola makes it 20, which is the same with that of his Corinthian; but Serlio, who first formed it into an order by giving it the proper entablature and base, and after him M. Perrault, raised it still higher than the Corinthian.

This last does not think different ornaments and characters sufficient to constitute a different order, unless it have a different height too; agreeably, therefore, to his rule of augmenting the heights of the several columns by a series of two modules in each, he makes the *composite* 20 modules, and the Corinthian 18; which, it seems, is a medium between the porch of Titus and the temple of Bacchus.

M. Perrault, in his Vitruvius, distinguishes between composite and composed order. The latter, he says, denotes any composition whose parts and ornaments are extraordinary, and unusual; but have, withal, somewhat of beauty, both on account of their novelty, and in respect of the manner or genius of the architect: so that a *composed* order is an arbitrary, humorous, composition, whether regular or irregular.

The same author adds, that the Corinthian order is the first composite order, as being composed of the Doric and Ionic, which is the observation of Vitruvius himself.

GOTHIC ARCHITECTURE.—After having described the five Orders, it will naturally be expected that we should say something of the *Gothic* style; we shall therefore give a general view of the distinguishing features of this species of architecture.

The attention to Gothic architecture having only been lately revived, the practice has not hitherto been digested into so systematic an order as the Greek or Roman; and it is not a little extraordinary, considering that during the ages in which it was extensively practised, its operations were directed by men of science and literary habits, that no written rules have been discovered in the religious houses which were then the only depositories of knowledge. This has led Mr. Knight, and other men of observation, to assert, that each architect proceeded independently of rules, and worked in the manner which to him appeared best calculated to produce a striking effect, and that it was in consequence of the absence of determined rules, that this school rose to the degree of sublimity it attained. This is denied by other able and enlightened men, who have paid much attention to the subject, especial-

ly Dallaway, Milner, and Hawkins, who maintain, that although few arranged rules and proportions have been published in books, yet architects and workmen were constantly guided by known rules, agreeably to the prevailing mode. It is evident, although not so rigidly confined as the Egyptian, that the Gothic architects were fully as much limited as the Roman; for the contrast between the massy Norman style, and the latter, or florid Gothic, is not greater than what was produced by varying from the plainness, simplicity, and oblong forms of the ancient Greek temples, to the circular, delicate, and highly ornamented edifices of the late Roman.

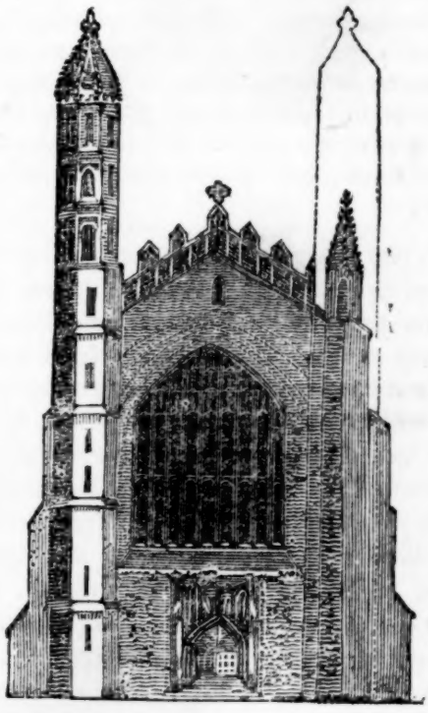
The Gothic style having been employed almost exclusively in edifices appropriated to the purposes of the Christian religion, the outlines of the ground plan have almost uniformly been a cross. In the Greek and Roman oblong temples, the ratio of the length and breadth was determined by the number of columns placed at nearly equal distances along the ends and sides, while that of the height was regulated by the diameter of the column; but in Gothic, where seldom any columns have been placed on the outside of the edifice, and the use of arches proving a relief from constraint within it, it is alleged that the proportion of the length to the breadth has been determined by triangles and squares. Of this, Mr. Hawkins, in his History of the Origin and Establishment of Gothic Architecture, (chap. 10,) has produced an early instance from Cæsar Cæsarianus, a celebrated architect of Milan, who, in an elaborate commentary annexed to his translation of Vitruvius, has explained the principles of Gothic architecture.

With regard to the form of the *essential parts*, they are mostly defined in the following description of the three orders of architecture, as given by Dr. Milner:

The *first order* is characterized during its formation—that is to say, till near the latter end of the 12th century,—chiefly by its acute arch (its pillars and other members being frequently Saxon); but after its formation, not only by the narrowness and acuteness of its arch, but also by its detached, slender shafts, its groining of simple, intersecting ribs, its plain pediments without crockets or side pinnacles, and its windows, which were either destitute of mullions, or have only a simple, bisecting mullion, with a single or triple trefoil, quatrefoil, or other flower, in the head of them. Of this order are the east end of Canterbury, the west end of Lincoln, and the whole of Salisbury Cathedrals, besides the transepts of York Minster and Westminster Abbey.

The *second order* is marked, not only by the fine turn of its perfect equilateral arch, but also by the cluster columns, being, for the most part, formed each course out of the same stone; by the elegant, but not over-crowded tracery of its windows and groining, by its crocketted pinnacles, tabernacles, and pediments, the latter of which, towards the conclusion of the fourteenth century, were made with an ogee sweep towards the arch they covered. To this order belong the nave of Westminster Abbey, the nave and choir of York Minster, the naves of Winchester, Exeter, and Canterbury Cathedrals, Wykeham's two colleges, St. Stephen's Chapel, &c.

The *third order* is known, not only by the flatness of the point of the arch, but also by its numerous, large, and low descending windows, together with the multiplicity and intricacy of its tracery; by its pendents from the roof; by the minuteness and profusion of its ornaments, both exteriorly and interiorly; by its fan-work and numerous shields and devices on the ceiling. To this order belong St. George's Chapel, Windsor, King Henry the Seventh's Chapel, Westminster and King's College Chapel, Cam-



bridge, of which the above is an eleva-

tion, showing on one side the buttresses, the tower being supposed to be removed, and on the other the tower, which not only supplies the place of a buttress at the end, but assists also in supporting a considerable portion of the thrust in the direction of the length of the chapel.

One of the finest features of Gothic architecture, and which, in many instances, still forms the most striking ornaments of our cities, is the tall, tapering spiral, which was first built of wood by the Normans, and afterwards in stone, early in the 13th century. In the course of the 14th and 15th centuries, they were greatly increased in number.

THE BIBLE.—Sir W. Jones, a most accomplished scholar, who had made himself acquainted with eight and twenty languages, has left it on record, that amidst all his pursuits the study of the Sacred Volume had been his constant habit. Sir Isaac Newton, the greatest of mathematicians, was a diligent student of the Bible. Mr. Locke, a man of distinguished acuteness in the study of the human mind, wrote to recommend the study of the New Testament: as having "God for its author, salvation for its end, and truth, unmixed with error, for its matter." Milton, the greatest of poets, evidently had his mind most deeply imbued with the study of the word of God. Boerhaave, eminent as a natural philosopher, spent the first hour of every day in meditation on the sacred pages. Here no man can say that he has not leisure. A most beneficent institution of our Creator has given us for this duty a seventh part of our time, one day in every week, one whole year out of every seven.

STATISTICS OF CONNECTICUT.—[The following article, from the Hartford Times, shows that the people of Connecticut must have pretty easy times. This freedom from taxation does not however always increase that patriotism which leads the people to take a deep interest in the affairs of their government.]

Through the attention of the comptroller of public accounts, we have been furnished with the following highly interesting statistics. It would be both gratifying and useful, would some one or more individuals in each state furnish similar tables. There certainly can be no great difficulty in obtaining them, and the labor that they might cost would be more than compensated by the information they would afford.

Statistics of Connecticut for the year 1832.

The following is a brief abstract of the various subjects of taxation, as returned by the assessors, for March, 1832:

45,852	dwelling houses, valued	$21,948,740
2,622,676	acres of land	50,782,455
1,572	mills	843,511
1,826	stores	146,784
283	distilleries	54,052
1,521	manufactories	1,637,149
25	quarries	38,350
183	fisheries	98,625
1	ferry	200
34,250	horses, &c.	1,290,694
237,989	neat cattle	3,347,667
271,625	sheep	333,657
	Silver plate	10,614
5,196	riding carriages	238,797
22,893	clocks and watches	174,843
	Bank stocks, state banks	3,143,736
	Do. United States Bank	17,880
	Insurance stock	53,642
	Turnpike do.	157,362
	Money at interest	2,087,976
	Three folds	17,679
	Assessments	147,683
	Polls	689,315
		$88,592,388

Of receipts and disbursements.

There was received at the treasury during the year ending the 31st of March, 1833—

From interest on U. S. three per cents.	$1,382
Tax on non-resident owners of bank stock	2,817
Avails of State Prison	5,000
Divid'd of bank stock owned by the state	25,670
Fines and miscellaneous receipts	7,448
State tax	37,984
	$80,302

The disbursements were—

For ordinary expenses of government	$60,852
For public buildings and institutions	10,774
	$71,626

Of the expenses of government.

The population of the state by the last census was 297,711, and the ordinary expense of the government was $60,852, being a proportionate expense of twenty cents and a half for each inhabitant. But the state, during this time, received $28,053 interest on her three per cent. stock and dividends on bank stock;

$12,446 from the state prison, forfeitures, fines, &c. and $2,817 for taxes on bank stock owned by non-residents; all amounting to $42,316; which being deducted from the ordinary expenses of government, left the sum of $18,536 to be paid from direct taxes.

This balance of $18,536 would require a contribution by each inhabitant of the state of less than six cents and three mills, and a tax less than three tenths of a mill on each dollar of valuation and assessment returned by the assessor.

Of the School Fund.

The whole capital of this fund, productive and unproductive, was reported by the commissioner in 1832 to be $1,902,957 87. The interest arising from it is irrevocably dedicated by the constitution to the support of primary schools, and by law is apportioned to them, according to the ratio of persons between four and sixteen years of age belonging to the respective school societies. The whole number of these persons in 1832 was 86,252; and the amount of interest distributed for that year was $81,939 40, being ninety-five cents for each of those persons, and equal to 28 cents for every inhabitant. Thus, while the state was distributing for the benefit of schools a sum equal to 28 cents for each person in it, the ordinary expenses of the government required of them only a ratio of contribution less than 6 cents and 3 mills.

Rational Amusement.—The love of literature has prevailed from very early times among the inhabitants of the remote island of Iceland. There the way in which the evenings of their long winter are spent furnishes a most agreeable contrast to the miserable pot-house debauchery which fills up the leisure of too many uncultivated Englishmen, and proves the value of well regulated knowledge as an auxiliary to virtue. A distinguished traveller, who spent a winter in Iceland, has described a winter evening in an Icelandic family, as rendered instructive and pleasing in the highest degree by the prevailing love of useful knowledge among all ranks. As soon as the evening shuts in, the family assemble, master and mistress, children and servants. They all take their work in their hands, except one, who acts as reader. Though they have very few printed books, numbers write excellently, and copy out the numerous histories of their own island. The reader is frequently interrupted by the head of the family, or some of the more intelligent members, who make remarks and propose questions to exercise the ingenuity of the children or the servants. In this way the minds of all are improved in such a degree, "that," says my informant, "I have frequently been astonished at the familiarity with which many of these self-taught peasants have discoursed on subjects, which, in other countries, we should expect to hear discussed by those only who have devoted their lives to the study of science." Let me not omit to add, that the evening, thus rationally and virtuously begun, is, by these well-instructed people, closed with an act of family devotion.—[From an excellent little work just published, "Bullar's Hints and Cautions in the Pursuit of General Knowledge."]

Animal Clock.—Mons. Chavannes, whilst residing during last summer at Wuarrens, near Echallens, had occasion to hear some account of a man who, without any uncertainty or mistake, could indicate the precise hour by day or night, and even the minutes and seconds; and this, it was said, he did by consulting his pulse. Induced by these reports to make close inquiry as to their foundation, he visited the man and obtained the following results:

His name is Jean Daniel Chevalley, aged 67 years. In his youth, the ringing of bells and vibrations of pendulums constantly attracted his attention, and he gradually contracted a habit of counting isochronous vibrations, and displayed considerable ability in calculations. When strong enough, he took pleasure in sounding the bells at school and church; and in his attention to town and church clocks, observed that the beats were 20 or 23 per minute, but more particularly 20, counting from the moment of departure to that of return. After this he endeavored to force his attention to the preservation, as long as possible, of an *internal movement*, similar as to the extent of time and number of vibrations. "At first," he says, "by adding 20 vibrations to other 20, or minute to minute, he could easily arrive at the conclusion of an hour, and mark all the subdivisions which he wished, and that without confusion; but the thoughts and corporeal occupations suffered by this attention. By degrees I was able to count whilst thinking and acting; but I could not proceed far, because my mind, making a certain effort for a length of time, though but slightly sensible to my-

self, became fatigued, and dropped the chain of calculation. Nevertheless, in 1789, I succeeded in acquiring the invariable possession of this faculty, which has never since left or deceived me."

He was then 22 years of age, and occupied at a school; but, in consequence of some singular habits, as that of sounding bells, and of some mystical notions he had acquired, and also certain disputes about the correction of the village clocks, he was dismissed, and went to his mill, where, continuing to sound his bells and make his clocks strike, he was nicknamed the Mummy of the Mill.

Being on board the steamboat on the lake of Geneva, (July 14, 1823,) he soon attracted attention by his remarks, that so many minutes and seconds had passed since they had left Geneva, or passed other places; and, after a while, he engaged to indicate to the crowd about him the passing of a quarter of an hour, or as many minutes and seconds as any one chose, and that during a conversation the most diversified with those standing by; and further, to indicate by the voice the moment when the hand passed over the quarter-minutes or half-minutes, or any other subdivision previously stipulated, during the whole course of the experiment. This he did without mistake, notwithstanding the exertions of those about him to distract his attention, and clapped his hands at the conclusion of the time fixed.

M. Chavannes then reverts to his own observations. The man said, "I have acquired by imitation, labor, and patience, an internal movement, which neither thoughts, nor labor, nor any thing, can stop; it is similar to that of a pendulum, which, at each motion of going or returning, gives me the space of three seconds, so that twenty of them make a minute, and these I add to others continually." The calculations by which he obtained subdivisions of the second were not clearly understood by M. Chavannes, but the man offered freely to give proof of his power. On trying him for a number of minutes, he shook his head at the time appointed, altered his voice at the quarter, half, and three-quarter minutes, and arrived accurately at the end of the period named. He seemed to assist himself in a slight degree by an application of mnemonics, and sometimes, in idea, applied religious names to his minutes up to the fifth, when he recommenced; this he carried through the hour, and then commenced again. On being told that the country people said he made use of his pulse as an indicator, he laughed at the notion, and said it was far too irregular for any such purpose.

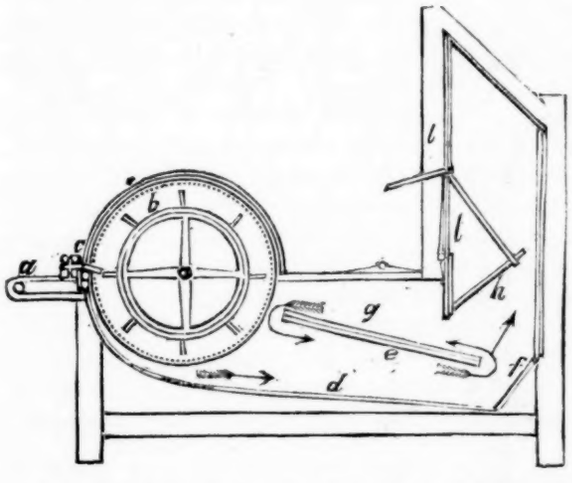
He admitted that his internal movement was not so sure and constant during the night; "nevertheless it is easy to comprehend," he said, "that, when I have not been too much fatigued in the evening, and my sleep is soft, if, after having awakened me without haste, you ask me what the hour is, I shall reflect a second or two, and my answer will not be ten minutes in error. The approach of day renews the movement if it has been stopped, or rectifies it if it has been deranged, for the rest of the day." When asked how he could renew the movement when it had ceased, or was very indistinct, he said, "Sir, I am only a poor man; it is not a gift of heaven; I obtained this faculty as the result of labors and calculations too long to be described; the experiment has been made at night many times, and I will make it for you when you please." M. Chavannes had not however the opportunity of making this experiment, but he felt quite convinced of the man's powers. He states that the man is deaf, and cannot hear at present the sound of his clock or watch; and further, that neither of these vibrate twenty times in a minute, which is always the number indicated by the motions of Chevalley when he wishes to illustrate his internal movement; and he is convinced, according to what he has seen, that *this man possesses a kind of internal movement, which indicates minutes and seconds with the utmost exactness.*—[Bibliotheque Universelle.]

Poisonous Beads.—Those beautiful red seeds with a black spot brought from India, which are sometimes worn as ornaments of dress, are said by the natives to be so dangerous, that the half of one of them is sufficiently poisonous to destroy a man. This account, however, seems to exceed probability; but that they have a very prejudicial quality, I have no doubt, for within my own knowledge I have seen an extraordinary effect of the poison of one of these peas. A poor woman, who had some of them given to her, and who did not choose to be at the expense of having them drilled to make a necklace, put the seeds into hot water till they were sufficiently soft to be perforated with a large needle; in performing this operation she accidentally wounded her finger, which soon swelled and became very painful, the swel-

ling extending to the whole hand; and it was a considerable time before she recovered the use of it. The botanical name of the plant that produces this pea is *Abrus precatorius*.—[Elements of Science of Botany, as established by Linnæus.]

Schools for Mechanics, &c.—The king of Bavaria issued a rescript in February last, directing the establishment of this description of popular schools in every quarter of his dominions, with the benevolent intention of affording the humblest workman an opportunity of receiving such instruction as may fit him for his calling. He permits the districts to name the masters of these schools for his approval. In large towns the course of instruction will take a wider range, and be given in "Colleges of Industry."

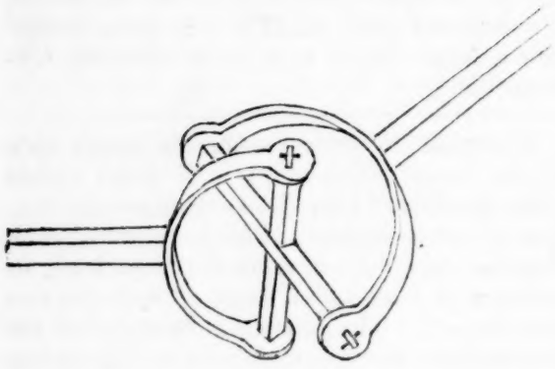
Method of Clearing Fur for Making Hats.—The preparation of hats is one of the principal uses to which fur is put in this country; we therefore select the present article for describing the mode of clearing the fur for that purpose. An account of the complete formation of a hat will be given in a future number. The patent improvements to which we are going to call the reader's attention are exhibited in the diagram beneath, and are intended to separate the finer portions of the fur from those that are less costly.



An endless web, or feeding cloth, is shown at *a*. It is extended on two rollers, upon which web the materials to be cleared and separated are placed, and by which they are carried forward into the machine. *b* is a hollow cylinder, with a flanch at each extremity. From the rims of these flanches a number of cords of catgut are extended and made tight. A peg or pin is so placed, the cords are put in vibration as they pass round, and thus take the material from the feeding cloth. To insure a requisite current of air for carrying the fur onward, vanes are placed in the cylinder *b*. The precise amount of current is determined by the regulator *e*, and the board *f*. The portions that are not sufficiently cleared are returned in the direction of the arrow towards *g*, while that which is completed goes out at *h*, and from thence into a large upper chamber.—[British Cyclopædia.]

Natural Wonder.—On the south side of the island (Mauritius) is a point called "the Souffleur" (the Blower), from the following circumstance: A large mass of rock runs out into the sea from the main land, to which it is joined by a neck of rock not two feet broad. The constant beating of the tremendous swell which rolls in has undermined it in every direction, till it has exactly the appearance of a Gothic building, with a number of arches in the centre of the rock, which is about thirty-five or forty feet above the sea; the water has forced two passages vertically upwards, which are worn as smooth and cylindrical as if cut by a chisel. When a heavy sea rolls in, it, of course, fills in an instant the hollow caverns underneath, and finding no other egress, and being borne in with tremendous violence, it rushes up these chimneys, and flies, roaring furiously, to a height of full sixty feet. The moment the wave recedes, the vacuum beneath causes the wind to rush into the two apertures with a loud humming noise, which is heard at a considerable distance. My companion and I arrived there before high water, and having climbed across the neck of rock, we seated ourselves close to the chimneys, where I proposed making a sketch, and had just begun, when in came a thundering sea, which broke right over the rock itself, and drove us back much alarmed. Our negro guide now informed us that we must make haste to re-cross our narrow bridge, as the sea would get up as the tide rose. We lost no time, and got back dry enough; and I was obliged to make my sketches from the main land. In about three-quarters of an hour the sight was truly magnificent. I do not exaggerate in the least when I say that the waves rolled in long and unbroken, full twenty-five feet high, till, meeting the headland, they broke clear over it, sending the spray flying over to the main land; while from the centre of this mass of foam, the

Souffleur shot up with a noise which we afterwards heard distinctly between two and three miles. Standing on the main cliff, more than a hundred feet above the sea, we were quite wet. All we wanted to complete the picture was a large ship going ashore.—[Journal of the Royal Geog. Soc.]



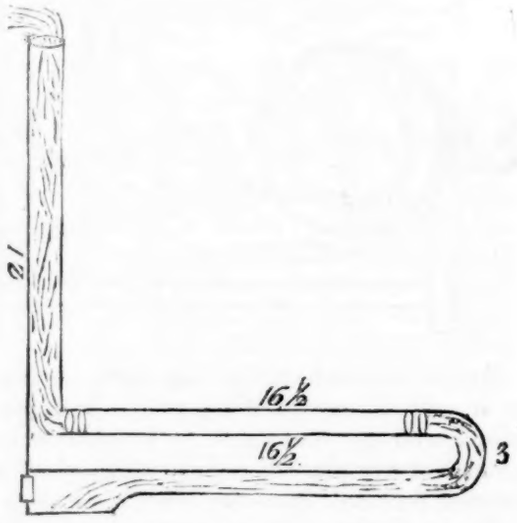
Dr. Hook's Joints.—The various joints employed in the human frame are all of the most perfect kind, though they differ considerably in their structure. The mechanic has, however, copied but two, the *hinge*, and the *ball and socket*. The hinge-joint is used for doors, and those places generally which require motion but in one direction. The ball and socket, on the contrary, admits of a variety of positions. The expense attendant on constructing the latter is very considerable, and to obviate this inconvenience the *Hook's-joint*, represented in the accompanying engraving, may be employed. It was originally invented by Dr. Hook, and is found very useful in communicating a rotatory motion from the principal axis of a machine to the more distant wheels it is intended to put in operation.

It consists of two semicircles, joined by a metal cross; and, if either of the semicircles be turned, a similar motion is communicated to the other. The same species of universal joint is employed to support a compass at sea.—[British Cyclopædia.]

Human Life.—Pliny has compared a river to human life. I have never read the passage in his works, but I have been a hundred times struck with the analogy, particularly amidst mountain scenery. The river, small and clear in its origin, gushes forth from rocks, falls into deep glens, and wantons and meanders through a wild and picturesque country, nourishing only the uncultivated tree or flower by its dew or spray. In this, its state of infancy and youth, it may be compared to the human mind, in which fancy and strength of imagination are predominant—it is more beautiful than useful. When the different rills or torrents join, and descend into the plain, it becomes slow and stately in its movements; it is applied to move machinery, to irrigate meadows, and to bear upon its bosom the stately barge; in this mature state it is deep, strong, and useful. As it flows on towards the sea, it loses its force and its motion, and at last, as it were, becomes lost and mingled with the mighty abyss of waters.

One might pursue the metaphor still further, and say, that in its origin, its thundering and foam, when it carries down clay from the bank and becomes impure, it resembles the youthful mind, affected by dangerous passions. And the influence of a lake in calming and clearing the turbid water, may be compared to the effect of reason in more mature life, when the tranquil, deep, cool, and unimpassioned mind is freed from its fever, its troubles, bubbles, noise, and foam. And, above all, the sources of a river, which may be considered as belonging to the atmosphere, and its termination in the ocean, may be regarded as imaging the divine origin of the human mind, and its being ultimately returned to and lost in the Infinite and Eternal Intelligence from which it originally sprung.—[Davy.]

Steamboat on the Susquehanna.—We have at length succeeded in obtaining the following description of the above boat:



Length, 95 feet; beam, 18 do.; draft, 15 inches; power, 35 horse. Length of boiler and height of chimney, see diagram above. The flame from an open burning bitumi-

nous coal, after enveloping the boilers 35 feet, we are informed is easily brought out from the top of the chimney, a distance of 56½ feet. Since the introduction of coal, two tons supply the place of eight cords of pine wood. It has been for some time known to the public, that a steamboat has been navigating some of the most rapid waters of the west branch of the Susquehanna during the present season, with entire success. The result of this enterprize is justly considered of great importance to the State of Pennsylvania. It now appears that there are many hundred miles above the public improvements, which may be navigated by steamboats, calculated to draw an up-river trade into the State canals.

There is another circumstance connected with this business, which is highly important to Pennsylvania, and to the Atlantic frontier generally. After a full trial, it is ascertained that a very small quantity in bulk of an open burning bituminous coal will answer every purpose for generating steam to propel boats, locomotive, and other steam engines. All the trials of bituminous coal for the above purpose, in New-York, and elsewhere in the United States, have heretofore been unsuccessful, in consequence of confining the heat and flame, thereby melting the grates, and preventing the flame from reaching and acting on the surface of the boilers. The error was in selecting the materials. All these difficulties are removed by the introduction of the above species of coal, which is almost free from bituminous smell. We believe we shall shortly see our locomotive engines propelled by a small quantity of this material, bringing from Columbia thousands of tons for our manufacturers. This is a new product of Pennsylvania. Let our neighbors of New-York and other states, who are now complaining of the price of wood, consider for a moment from where a substitute is to come, to propel their steamboats and other machinery: they will find it in the open burning bituminous coal of Pennsylvania.—[Phil. C. Her.]

New Engine.—The Earl of Dundonald has made a most successful trial of his newly invented rotary steam engine. A boat was propelled with great rapidity, and turned backwards and forwards through Westminster bridge several times. The engines are not larger than two Cheshire cheeses, and the whole apparatus so compact that a frigate's launch could be fitted with it. His lordship was accompanied by Mr. Ogle, Captain Brown, Mr. G. J. Mangary, &c. Some slight alteration, in a very minor detail, will be made, when their great improvement will be deemed complete, and applicable to our navy.—[London Herald.]

Manufacture of Cotton in the United States.—The New-York Mercantile Advertiser contains the subjoined interesting article:

We proceed according to our promise, to give further statements of the state of the Cotton manufactured in the United States, in 1831, as collected by the Committee of the New-York Convention. In our paper of Saturday last we showed that there were in twelve States of the Union, 795 cotton mills, with a capital of 40,714,984 dollars, manufacturing annually 77,751,316 lbs. of Cotton, or 214,882 bales of 361$\frac{86}{100}$ lbs. each.

Number of Spindles - - -		1,246,903
Do. of Looms - - -		33,506
Pounds of Yarn sold - - -		10,642,000
Yards of Cloth made - - -		230,461,900
Pounds of Cloth - - -		59,604,925
Hands employed—Males	18,539	
Females	38,927	
		57,466
Pounds of Starch used - -		1,641,253
Barrels of Flour for sizing - -		17,245
Cords of Wood burnt - -		46,519
Tons of Coal do. - -		24,420
Bushels of Charcoal burnt - -		9,205
Value of other articles consumed not enumerated - - - -		$599,223
Spindles then building - -		172,924
Gallons of Oil consumed - -		300,338
Hand Weavers - - -		4,760
Total dependents - - -		117,626
Annual value of Cotton Manufactures - - - - -		$26,000,000
Aggregate or total annual amount of wages paid - - - -		$10,294,944

That there may be no doubt as to the accuracy of these statements, we give the names of the following gentlemen, through whose means the accounts were collected from the manufacturers in the different States, viz.: Maine and New-Hampshire, Lloyd W. Wells and John Williams; Massachusetts and Vermont, Robert Rogerson & Patrick T. Jackson; Rhode Island, Jas. De Wolf, James F. Simmons and Charles Jackson; Connecticut, J. H. De Forest; New-

York, E. B. Sherman, James Wilde and Richard P. Hart; New-Jersey, Kentucky, Ohio and Indiana, David Holsman and Mark W. Collet; Pennsylvania, Delaware and Tennessee, Levi Waln and Alexander Breckenridge; Maryland and Virginia, Columbus James, Columbus O'Donnell and J. W. M'Culloch.

THE POPULATION OF THE UNITED STATES.—The Boston Journal has some interesting suggestions on this subject, derived from the last Quarterly Register.

The greatest population to a square mile is in the District of Columbia, where it is 393; in Connecticut, 63; in Rhode Island, 72; Massachusetts, 81; Maryland and New-Jersey, 40; Ohio, 24; New-York, 41; Pennsylvania, 30.

The population of New-York in 1840, it is supposed, will be 2,500,000, or 200,000 more than that of all New-England, and about equal to that of all the North-Western Territories. That of Pennsylvania is rated at 1,700,000; of Ohio, 1,300,000. That of Virginia is put at a few thousand more. And thus the oldest settled of the States, which in 1790 had a population of 747,000, will have been overtaken by a State which had no government of any kind until one year before that date, did not become a State until 1802, and had in 1790 a population of only 3000. Indeed, Ohio has the resources within itself for growing into the greatest State of the Union. It can support, without difficulty, a people as dense as that of Holland.

Ohio contains but 39,000 square miles, while Virginia contains 64,000, which is within 1000 of the whole area of New-England, and makes Virginia the largest as well as the oldest State. The next in order is Georgia 62,000, and Missouri 60,000. Illinois contains 55,000, Florida 50,000, New-York 46,000, Pennsylvania 44,000, North Carolina and Louisiana 48,000 each. Delaware contains 5100, and Rhode Island 1350.

The most rapid increase of population we observe is in the case of Ohio, which increased from 3000 to 45,000 in ten years, and in the next ten to 230,000. This last was at the rate of 409 per cent. in ten years, whereas the average rate of the whole Union for the last 10 has been but 33 per cent. and that of New-England but a little less than 19. That of New-York was never greater than 72; of Maine, 58; Illinois, 350; Indiana, 500; Michigan, 764; Arkansas, 1344. The most rapid increase has, of course, been in the early settlements.

The population of the United States in 1480 is rated at 17 millions. What it will be a hundred years hence, it is not easy to calculate. What it *may* be, however, is inferible from the fact that our territory is immensely extensive; that a vast amount of rich land is yet unoccupied; that lands now cultivated may be made vastly more productive; that a large portion of our country is under tropical climates; and that if the whole country should support but 230 inhabitants to a square mile, as England now does, we should have, as the editor of the Register observes, more than *four hundred and fifty millions.*

RAILROADS AND LOCOMOTIVE ENGINES.—[We extract the following from memoranda of a friend, taken during a late visit made to several of the most important railroads in the country, with a view of examining the different locomotive steam engines, in order to ascertain their practical effects on the several roads, and to collect and compare such facts connected with the subject as fell under his observation.]

The first road I visited was the Mohawk and Hudson, extending from Albany to Schenectady, a distance of 16 miles. Of this distance their locomotive engines work 12½ miles.

The John Bull, an English engine, has been at work upon this road with perfect success since October, 1831. From the great weight upon her driving wheels, she was found to injure the road, and during the last winter she was put upon six wheels, after the plan adopted by J. B. Jervis, Esq. in the locomotive "Experiment," which had been fully tested the past year on the same road. They still do a part of the work on this road with horses, and in order to compare more accurately the expense of horse and steam power, Mr. Whitney, their intelligent superintendant, informed me that he had the last spring opened an account with each, and found the result to be as 3 to 5, in favor of steam, and this where wood is worth from four to five dollars per cord.

The Saratoga road connects this road with the village of Saratoga, and is 22 miles in length. This road was opened for travel in July, 1832. The first locomotive engine commenced her regular trips in June last, and has since continued to work in the most sat-

isfactory manner. She is called the Saratoga, burns coke, is a six-wheel engine, and taking into view the ease with which she works upon, and the little injury she does the road, I consider her the best engine I have seen.

The next road in course was the Camden and Amboy, which has one track laid to Bordentown, 36 miles. It is constructed after the English plan, with Mr. R. Stevens' improved iron rails; and that part of the track which has been recently laid has a better surface than any railroad I have ever seen, either in this country or in England. Passengers are still carried on this road by horses, 180 of which, I am informed, are required to perform the business 36 miles. Arrangements are making to convey passengers by steam, which will be completed in a short time. Three or four engines are already on the road, and as many more nearly in readiness. I saw one of these conveying materials for construction, and was much pleased with the power she exhibited to overcome ascents with her load.

I next visited the Philadelphia and Germantown road, 6½ miles of which are completed, and traversed by two locomotive engines, both of which were constructed in this country. The one constructed by Mr. M. W. Baldwin, of Philadelphia, has performed for five or six months in the most satisfactory manner. Mr. B. has introduced some simplification of the usual plan, of working the valve, gear, and reverse, by hand, which gives that part of his engine a decided preference over most of the English engines.

The grade of the road is very unfavorable for this kind of power, having an average ascent of 35 feet per mile, on which are several very abrupt curves. And here I cannot but observe how important it is in constructing a railroad, where the locomotive engine is designed to be used, that no *reasonable pains or expense should be spared* to bring both the *grade* and *line* of the road within the *effective power* of that useful machine. To illustrate this, the engine constructed by Mr. Baldwin would lead seven or eight cars, on a level and straight road, with as great ease as she carries three cars up this road.

The Newcastle and Frenchtown road was next in my way. This road is 16 miles in length, and has been completed and worked with the locomotive engine for the last eighteen months. They have at present four engines on the road, all constructed by R. Stephenson, Newcastle, England; and, with the exception of one, they have worked very satisfactorily. Mr. Young, a very intelligent and practical engineer, who has charge of the engines, informed me that they had lost but two or three trips since they commenced running them. I was much pleased with the organization and police of this road. I passed in company with about a hundred passengers, and the whole time of transshipping them with their baggage, from the steamboat to the cars, to the time we were under-way on the road, did not exceed five minutes, and an equally short period in again transshipping to the boat at the other end of the road. The engine had eight cars in train, and occupied 63 minutes in crossing. The grade of this road is very favorable for this kind of power, the whole being within 16 feet per mile, with the exception of a few yards at each end.

The Baltimore and Susquehanna Railroad is completed, and worked by an engine, 16 miles from Baltimore, passing in almost its whole extent through a very broken and undulating country. The greater part of this road ascends at the rate of 10 feet per mile, and is a continued series of curves, ranging from 400 to 1000 feet radius, and many of these occurring in the ascents. It is consequently a very unfavorable road for the locomotive engine. They have an engine on this road, which burns coke, and was originally on four wheels, by which arrangement it was found impossible to pass the curves, when she was put upon six wheels, similar to the Saratoga, except that her furnace is outside the driving shaft. She is an engine of great capacity, and her weight on the driving wheels has injured both the wooden rail and the iron, very materially. Yet notwithstanding the very bad order of the road, she carried a train of seven cars, round the most abrupt curves, at a speed of eight or ten miles per hour.

The Baltimore and Ohio road has been so frequently described that I shall only refer to the motive power used upon it, which, for the most part, is animal. They have an engine which they work upon the road part of the time. This is a geared engine, communicating her power to the main shaft by a spur wheel. The principal merit of this engine is her success in generating steam with anthracite coal, which is certainly more satisfactory than any thing I have heretofore seen, and fully confirmed my previous opinion, that this fuel will eventually be used

for the transportation of passengers, in all cases where it can be obtained at fair rates. The Baltimore Company feel confident of success with this kind of fuel, and have contracted for two or three engines adapted to its use.

The last object of my tour was the Petersburg and Roanoke Railroad, in Virginia. This road is now completed from Petersburg to the Roanoke, a distance of about 60 miles. The grade of the road, with the exception of two or three planes, with an ascent of 27 to 30 feet per mile, is very favorable to the use of the locomotive engine; and their success with this kind of power has not been surpassed in the country. They have now three engines upon the road, a part of which have been at work upwards of nine months, and made their trips with as much regularity as could have been expected from horse power. One of these, the "Liverpool," is probably, for her weight, the most effective engine in the country. This, and one of the other engines on this road, were constructed by Mr. Burry, of Liverpool, who has also furnished two engines for one of the Schuylkill railroads, which I am informed work equally well. The proprietors of this road consider it as part of the great line of communication from north to south, and look to its ultimate connection with the Charleston Railroad, by similar works, through North Carolina.

The opening of the Charleston Railroad to Augusta, which is advertised for the first of October next, in connection with the two lines of steamboats now being established between New-York and Charleston, and between Norfolk and that city, will, with the exception of the short distance from Augusta to Montgomery, complete the facilities of the great line of communication from Boston to New-Orleans, and I venture to predict that, before the expiration of three years, the mail will be transported from this city to New-Orleans in the short space of eight or nine days; and that to avoid the rigors of a northern winter, a trip to the sunny regions of the south will soon become as common as the visits from that quarter to the north are in the summer.

Fearing I have already extended my remarks to a tiresome length, I will not trouble you with a detail of the measurement and proportions of boilers, engines, &c. but cannot refrain from assuring you, that although I was one of the earliest and most strenuous advocates in this country for the introduction of railroads,* and the use of steam as a motive power, the result of all my observations during my journey has more than confirmed the most sanguine hopes I ever entertained of their success.

But the most gratifying part of the details—and that which, as an American citizen, and a member of this great republic, most flatters my vanity—is the proud recollection that the whole of this trip, from the city of New-York to Saratoga, from Saratoga to the interior of Virginia, near the North Carolina line, and thence again to this city, making the distance travelled more than 1500 miles, was performed by railroad and the splendid steamboats which ply on the noble waters of the Hudson, Delaware, Chesapeake Bay, and James river, without any *fatigue* or *sacrifice* of *personal comfort, in the short space of nine days*, including a detention of 96 hours, or four days, at the different places I visited, making the travelling time but *five days* for the *whole distance*.

Yes, Mr. Editor, I think every American citizen may justly feel proud, when he reflects on the rapid progress of these facilities of internal communication, which are so rapidly springing up on every side, and intersecting our country from north to south, and from east to west, forming the great avenues of intercourse with every part of our extended confederation, and which alike strengthen the bonds of our happy union, and give an additional guarantee for the stability and permanency of our government and institutions.

New Process for Cleaning Linen.—The Society for the Encouragement of Arts and Manufactures have rewarded Mrs. Morris for a method of cleaning silk, woollen and cotton goods, without injury to the texture or color. Take raw potatoes, and let them be well washed, and rubbed on a grater over a vessel of clean water to a fine pulp. Pass the liquid matter through a coarse sieve into another tub of clean water; let the mixture stand till the fine white particles of the potatoes are precipitated; then pour the mucilagenous liquor from the fecular, and preserve the liquor for use. The article to be cleansed should then be laid upon a linen cloth on a table, and sponged repeatedly with the potatoe liquor till the dirt is perfect-

* I never believed in the practicability of a railroad to the moon—never thought railroads could be worked and kept in repair without great expense; or that, if constructed where there was no business, they would pay large dividends.

ly separated. The article should then be washed several times in clean water, to remove the loose dirt, and may be afterwards smoothed and dried. The coarse pulp which does not pass the sieve is asserted to be of great use in cleansing worsted curtains, tapestry, carpets, and other coarse goods. The mucilaginous liquor of the potatoes will clean silk, cotton, or woollen goods of any kind, without damaging the texture of the article, or affecting the color. It is farther applicable to the removal of dirt from oil paintings or soiled furniture; and the dirty painted wainscots may be cleansed by wetting a sponge in the liquor, then dipping it in a little fine clean sand, and rubbing the wainscot. —[London paper.]

Dredging Machine.—We recently had the pleasure of witnessing the operation of a newly invented and highly improved Dredging Machine, employed upon the canal to remove deposits of mud under water. It is the invention of our townsman, Capt. O. Teall, who has been 4 or 5 years in bringing it to its present state of perfection. The Machine is attached to a common scow, and is worked by one span of horses. Its merits have been fully tested, we understand, by the Superintendants of Repairs upon the whole line of the canal, and is confidently recommended by them all to the use of the State. It is peculiarly adapted to the purpose of clearing the bed of the canal, subject to the consequences of sudden freshets on the Mohawk, where heretofore it has been necessary to draw off the water to remove impediments. Where we saw it in operation, as much mud was removed by it in an hour and an half, with the water at full height, as would have cost $25 by the ordinary method. We understand that the inventor is confident that it is adapted to the removal of the obstructions in the Hudson river, below Albany, where he intends to make a trial with it. We should judge that it must eventually come into use on canals generally. —[Onondaga Standard.]

City of Philadelphia.—As a proof of the prosperity of Philadelphia, the enterprize and spirit of her citizens, the public improvements in progress, and the anticipated internal advantages in our city, the Commercial Herald had recently two articles on the local statistics of our city, chiefly relative to the public buildings or works recently completed or now in preparation. We extract the list, as compiled for the Philadelphia Gazette, with the computed cost of each building or work:

The Fairmount Water Works cost	$2,063,000
Bank of the United States - -	413,000
Bank of Pennsylvania - - -	235,000
Girard Bank - - - - -	250,000
Philadelphia Bank - - -	50,000
Mint - - - - - - -	175,000
Arcade - - - - - -	162,000
University, (new buildings only,) -	60,000
Chesnut street Theatre - -	75,000
Arch street Theatre - - -	63,000
Franklin Institute - - -	34,000
Schuylkill Permanent Bridge -	300,000
Upper Ferry Bridge, Fairmount, -	110,000
Arsenal on the Schuylkill, below South street, - - - - - -	150,000
First Presbyterian Church, Washington Square, - - - - - -	55,000
St. Andrew's Church, 8th, above Spruce street, - - - - - -	65,000
City Prison, corner Broad and Arch sts.	50,000
American Sunday School Union -	42,600
Sixth Presbyterian Church, Spruce st.	30,000
Baptist Church, Sansom street, -	33,000
Twelfth Presbyterian Church, 12th and Walnut streets, - - -	30,000
Baptist Church, Spruce street, -	25,000
Custom House and Stores - -	97,100
Farmers' and Mechanics' Bank, -	50,000
Commercial Bank, - - -	27,000

To these may be added the Pennsylvania Institution for the Deaf and Dumb, Academy of Fine Arts, Academy of National Sciences, Masonic Hall, City Library, Orphan's Asylum, Widow's Asylum, Walnut st. Theatre, Pennsylvania Hospital, Almshouse, Hall of Independence, and a long list of other public buildings, and upwards of one hundred churches, the cost of which we are unable to state.

The following Public Buildings are now in progress:

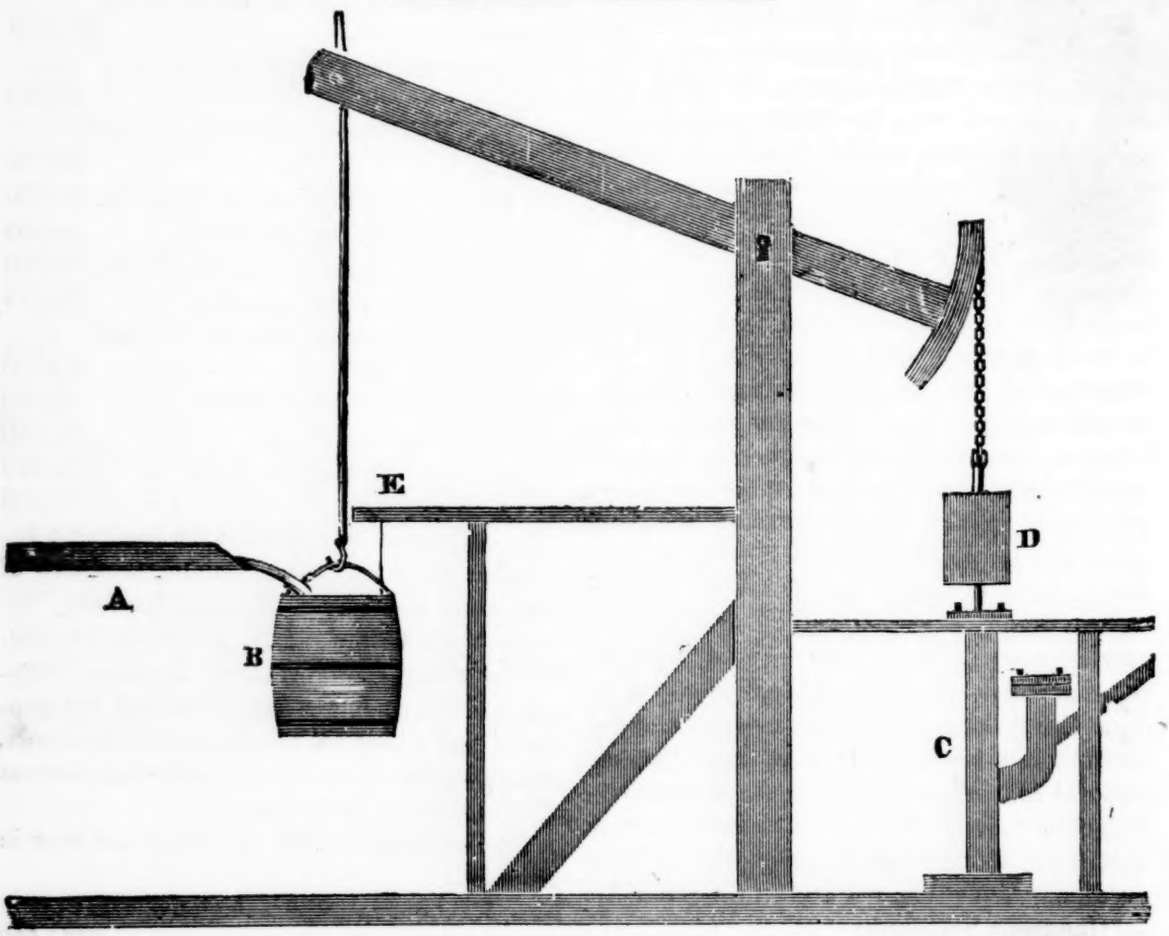
New Exchange, to be completed next year, architect's estimate - -	$250,000
Naval Asylum, to be completed this season, - - - - - -	250,000
Penitentiary, to be completed this season,	510,000
County Prison - - - - -	228,000
Will's Hospital, for the Lame and Blind, to be completed this season, -	50,000
Almshouse, completed next year, 7 to	800,000
Central Presbyterian Church, estimate	58,000

Girard College, just commenced, architect's estimate - - - -	$90,000
Bricklayer's Hall - - - -	11,000
Moyamensing Hall - - - -	13,000
South front of Girard's Square, sixteen houses, 4 stories high, with marble basements, - - - - -	256,000
North side of Girard's Square, twenty-two houses, - - - - -	200,000
Railroad in Broad, from Vine to South street, - - - - - -	60,000
Public School, Front, near Pine street,	10,000
Girard appropriation for improving the eastern front of the city - -	500,000

From this statement it will be seen that the cost of the Public Improvements in progress at this time amount to nearly *four millions and a half of dollars.*

And on the assessed value of real estate in the city and county of Philadelphia—excluding all the public buildings, all the churches, the squares, burying grounds, &c. none of which are subject to taxation—the Herald has been able to ascertain the average value:

In the City and Liberties -	$95,063,057 50
Penn township, Germantown, Roxborough, Bristol, Oxford, Byberry, Moreland, Lower Dublin, Blockley, and Kingsessing, - - - - -	11,872,350 00
Total, - - -	$106,935,407 50



IRRIGATION.—The watering of kitchen gardens is common to all countries, and has been probably used in all ages. It is generally effected in the most expensive manner; a common watering pot is used by the hand, and the water carried to the garden in small quantities, and often from a considerable distance. Yet it is a fact, that no acre of land belonging to a farm yields so great a net profit as the acre employed as a kitchen garden. The farmers of Gloucestershire, in England, commence making cheese a month earlier than their neighbors, and this only because they flood their lands in winter, and thus the roots of the grass are preserved from being injured by the frost, and an early spring of grass secured. The ex-

pense of this irrigation, in many instances, exceeds twenty dollars an acre. The grand canal, now in this State, will give many opportunities of irrigating land; it might be the interest of the State to introduce large supplies of water into the canal, with a view to sell the spare water to farmers owning land within two miles of it, for it would not be too expensive to lead it so far wherever no great impediment intervened. A farmer, who owned fifteen acres of land near the grand canal in Ireland, caused his field to be made into ridges, 60 feet wide, each ridge rising gradually to the top, on which he made a small canal, about one foot wide and one foot deep, these being supplied at pleasure from the canal, and by its overflowing watered the ridge on each side, and was carried off through small runners between the ridges—this was very expensive, but was yet very profitable to the owner of the land. It appears from a communication to the Board of Agriculture, that a Mr. Purdy, of Norfolk, watered his meadows at the expense of thirty pounds sterling ($133 33) per acre, and found it to his advantage; he was offered and refused five guineas ($23 34), as an annual rent for his grass lands.

Much benefit has been derived from the ingenuity of mechanics and others, in making labor-saving machines. In what respect could genius be so usefully applied as in suggesting cheap modes of supplying water to farms? The following plan and description of a machine for raising water, is copied from the *Domestic Encyclopædia*. It is not expensive, and is given partly with a view to engage *American genius* in the invention of some plan still cheaper, for *cheapness is particularly material to the farmer.*

"In the year 1801, the Society for the Encouragement of Arts, &c. adjudged their silver medal to Mr. H. Sargeant, of White-Haven, Cumberland, for a *machine for raising water*, of which we give an engraving.

"This engine was erected at Irton-Hall, which is situated on an ascent of sixty or sixty-one feet perpendicular height. At the foot of this elevation, about one hundred and forty yards distant from the offices, there runs a small stream of water: and, in order to procure a constant supply of that necessary fluid, the object was to raise such stream to the house, for culinary and domestic uses. With this view a dam was formed, at a short distance above the current, so as to cause a fall of about four feet; the water was then conducted through a wooden trough, into which a piece of leaden pipe, two inches in diameter, was inserted, and part of which is delineated at A.

"The stream of this pipe is directed in such a manner as to run into the bucket B, when the latter is elevated; but as soon as it begins to descend, the stream passes over it, and flows progressively, to supply the wooden trough or well, at the foot of which stands the forcing-pump C, being three inches in diameter.

"D is an iron cylinder, attached to the pump-rod, which passes through it; such cylinder is filled with lead, and weighs about two hundred and forty pounds.* This power works the pump, and forces the water to ascend to the house, through a pipe, one inch in diameter, and which is four hundred and twenty feet in length.

"At E is fixed a cord, which, when the bucket approaches to within four or five inches of its lowest projection, extends, and opens a valve in the bottom of the vessel, through which the water is discharged.

"The machine here described had, at the time of Mr. Sargeant's communication to the Society above mentioned, been six months in use, and fully answered the purpose for which it was designed. The artizans employed were a plumber, blacksmith, and carpenter; the whole expense, exclusive of the pump and pipes, did not exceed five pounds ($22 23)."

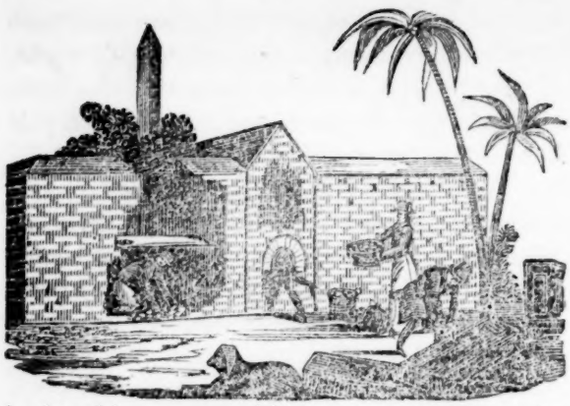
On the Preservation of Machinery in Working Order. By G. K. O. To the Editor of the Mechanics' Magazine.

Sir,—Observing in your July number an article on the preservation of machinery in working order, I thought it not improper to suggest as a further means of preventing rust, that the several parts of a machine be enveloped in thin plates of zinc, which, by its superior affinity for oxygen, will prevent it from uniting with the iron.

Yours, &c. G. K. O.

Egyptian Egg-Oven.—It is a well-known fact, that eggs may be hatched by artificial means. The Egyptians, as well as those who have tried the experiment in Europe, have succeeded, by means of artificial heat,

* The farmer, who looks more to real use than to neatness of execution, may make the cylinder of wood, and fill it with stones, bricks, or other convenient matter.



in hatching eggs without any aid from the mother birds.

According to the best descriptions of the Egyptian *mamal*, or hatching oven, it is a brick structure about nine feet high. The middle is formed into a gallery about three feet wide and eight feet high, extending from one end of the building to the other. This gallery forms the entrance to the oven, and commands its whole extent, facilitating the various operations indispensable for keeping the eggs at the proper degree of warmth. On each side of this gallery there is a double row of rooms, every room on the ground floor having one over it of precisely the same dimensions, namely, three feet in height, four or five in breadth, and twelve or fifteen in length. These have a round hole for an entrance of about a foot and a half in diameter, wide enough for a man to creep through; and into each are put four or five thousand eggs.

When the fires have been continued for eight or twelve days, according to the weather, they are discontinued, the heat acquired by the ovens being sufficient to finish the hatching, which requires in all twenty-one days, the same time as when eggs are naturally hatched by a hen.

The number of ovens dispersed in the several districts of Egypt has been estimated at 386; and it has been computed that a million of chickens are annually hatched, in this manner, in Egypt.—[People's Mag.]

Lambert's Cane Rifle.—This drawing represents the most compact and convenient rifle that we have ever seen, and we think has ever been invented.

The top figure represents it entirely shut, having the appearance of a substantial walking cane.

In the figure underneath it is represented ready for firing, in which position it can be placed almost instantaneously. The head is drawn out sufficiently far for the socket or ferule at the muzzle, (which is attached by a strap of metal in the side of the socket, with a hinge at the extremity,) to fall off by its own weight, (see drawing.) The cock is a bent lever of steel, made to turn and move on a hollow pivot pin, containing a chamber for powder, which is continued through the screw by which it is inserted, and opens into the barrel. The trigger lays in the plate which covers the lower side of the cock. By bending down the head of the cane (see drawing) the lower edge of the slide plate* catches a small dog of steel, with a notch or tooth in it, which rests on a spring let into the foot of the cock, and thus elevates the long arm of it. The head thus bent serves for a breech, by which the gun is conveniently held and aimed, by looking through a small slit in the cock over the sight in the ferule.

Literary Notice.—Mr. Lomas, stenographer and reporter, of this city, has announced for publication, on 1st October, a periodical entitled the "City Hall Reporter." It is to be continued monthly, each number to consist of sixty-four closely printed pages, at six dollars per annum, and to contain reports of cases tried in all the courts here. It is Mr. Lomas' intention to make this work an impartial record of events that occur in those courts, and faithfully to report the arguments of counsel on both sides, as well as the summing up of the judge. To the profession generally, and more particularly to those who practise out of the city, the work will be invaluable.

We are glad to observe that Mr. L. purposes to include in his reports all the wit and humor which are continually called forth among members of the bar. If a collection could be made of such gems, it would form one of the most amusing volumes ever issued from the press, combining as it would much of the ludicrous and pathetic, enriched with the lively sallies of wit of such men as Emmett, Brougham, Eldon, Ellenborough, O'Connell, and a host of others.

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* By "slide plate" we mean a cylindrical metal plate of even diameter, about three inches in length, which is inserted in the head of the cane, and which encloses the lock when it is shut up.

On the Improvement of Society by the Diffusion of Useful Knowledge. By THOMAS DICK, LL. D., Author of the "Christian Philosopher," &c. &c. New-York, 1 vol. 18mo. pp. 442; J. & J. Harper, 1833.

The enterprising publishers, whose names appear on the title page of this volume, deserve the thanks of the friends of knowledge for bringing before the public, in an economical form, works of sterling merit, such as the one now before us. It is written in a beautiful and easy style, and suited to the most moderate capacity. The contents of every page are important and interesting to every true lover of science and intelligence. We select the following from his description of the *Pleasures connected with Science:*

"The man of knowledge, even when shrouded in darkness, and in solitude, where other minds could find no enjoyment, can entertain himself with the most sublime contemplations. He can trace the huge globe on which we stand flying through the depths of space, carrying along with it its vast population, at the rate of sixty thousand miles every hour, and, by the inclination of its axis, bringing about the alternate succession of summer and winter, spring and harvest. By the aid of his telescope he can transport himself towards the moon, and survey the circular plains, the deep caverns, the conical hills, the lofty peaks, the shadows of the hills and vales, and the rugged and romantic mountain scenery which diversifies the surface of this orb of night. By the help of the same instrument he can range through the planetary system, wing his way through the regions of space along with the swiftest orbs, and trace many of the physical aspects and revolutions which have a relation to distant worlds. He can transport himself to the planet Saturn, and behold a stupendous ring, 600,000 miles in circumference, revolving in majestic grandeur every ten hours around a globe nine hundred times larger than the earth, while seven moons larger than ours, along with an innumerable host of stars, display their radiance to adorn the firmament of that magnificent world. He can wing his flight to the still more distant regions of the universe, leaving the sun and all his planets behind him, till they appear like a scarcely discernible speck in creation, and contemplate thousands and millions of stars and starry systems, beyond the range of the unassisted eye, and wander among suns and worlds dispersed throughout the boundless dimensions of space. He can fill up, in his imagination, those blanks which astronomy has never directly explored, and conceive thousands of systems and ten thousands of worlds, beyond all that is visible by the optic tube, stretching out to infinity on every hand,—new creations incessantly starting into existence—peopled with intelligences of various orders, and all under the superintendance and government of the "King Eternal, Immortal, and Invisible," whose power is omnipotent, and the limits of his dominions past finding out.

"It is evident that a mind capable of such excursions and contemplations as I have now supposed, must experience enjoyments infinitely superior to those of the individual whose soul is enveloped in intellectual darkness. If substantial happiness is chiefly seated in the mind, if it consists in the vigorous exercise of its faculties, if it depends on the multiplicity of objects which lie within the range of its contemplation, if it is augmented by the view of scenes of beauty and sublimity, and displays of infinite intelligence and power, if it is connected with tranquility of mind, which generally accompanies intellectual pursuits, and with the subjugation of the pleasures of sense to the dictates of reason—the enlightened mind must enjoy gratifications as far superior to those of the ignorant man, as man is superior in station and capacity to the worms of the dust."

It is an opinion entertained by a vast number of operatives, that their pursuits are not suited to study and scientific research. Dr. Dick forcibly refutes this popular fallacy thus:

"The mechanic whose mind is enlightened with scientific knowledge *has a much greater chance of being instrumental in improving the arts than the mere chemist or philosopher.* While the mere philosopher is demonstrating principles and forming theories in his closet, and sometimes performing experiments, only on a *small* scale—the workman, in several manufactories, has a daily opportunity of contemplating chemical processes and mechanical operations on an *extensive* scale, and of perceiving numberless modifications and contrivances, which require to be attended to, of which the mere scientific speculator can form but a very faint and inadequate conception. Being familiar with the most minute details of every process and operation, he can perceive redundancies and defects imperceptible to other observers; and if he has an accurate

knowledge of the general principles on which his operations depend, he must be best qualified for suggesting and contriving the requisite improvements. As the mechanic is constantly handling the tools and materials with which new experiments and improvements may be made,—observing the effects of certain contrivances and of deviations from established practice,—and witnessing the chemical and mechanical actions of bodies on each other,—he has more opportunities of observation in these respects, and, consequently, is more likely than any other class of society to strike out a new path which may lead to some useful invention in the arts, or discovery in the sciences. But if his mind is not imbued with knowledge, he trudges on, like a mill-horse, in the same beaten track, and may overlook a thousand opportunities of performing experiments, and a thousand circumstances which might suggest new improvements.

"In short, in so far as chance is concerned in new discoveries and improvements in the arts, the scientific mechanic has a hundred chances to one, compared with the ignorant artificer, that, in the course of his operations, he shall hit upon a new principle or improvement: his chances of such results are even superior to those of the most profound philosophers who never engage in practical operations, as he is constantly in the way of perceiving what is useless, defective, or in any way amiss in the common methods of procedure. To use a common expression, 'he is in the way of good luck, and if he possesses the requisite information, he can take the advantage of it when it comes to him.' And should he be so fortunate as to hit on a new invention, he will probably enjoy, not merely the honor which is attached to a new discovery, but also the pecuniary advantages which generally result from it."

This is a fit companion for that admirable little volume of Robt. Mudie's, noticed at page 51, vol. ii. of this Magazine; and while the publishers use such discrimination in their selections for the volumes of the "Family Library," we most cordially wish that the circulation of them may be extended as universally as they in their most sanguine moments ever wished them to be.

German Parables. By KRUMMACHER. Peabody & Co., 18mo., pp. 216. New-York, 1833.

It is a fact that happiness of mankind flows, in a great measure, from the influence which small matters have upon the mind. He who is not enlivened by the morning song of the feathered race—he, who is not cheered with the smiles of infant innocency—he, who is not delighted with the picture of domestic or fire-side happiness—is a stranger to the pure and unadulterated feelings that constitute all that is lovely and virtuous in the principles of human society. So he, who cannot see any beauty in, nor derive instruction from, a simple parable that illustrates nature, sees the world in its ore, and knows not of the brilliant and refined riches which it contains. German pens flow smoothly and sweetly, especially when instruction and amusement are their object.

A Treatise on Railway Improvements. By RICHARD BADNALL, Esq. London, Sherwood & Co.

The volume now before us is of the argumentative kind, recommending the author's invention; and at p. 31, he thus describes his ideas on the subject: "The improvements in the formation or construction of railways, to which these pages principally refer, is the substitution of a curved or undulating, or, what I denominate, a 'serpentine railway,' for the horizontal railway now in use. The impressions upon my mind, before the trial of any experiments, were, that by an undulating railway *a greater resistance would be opposed to the power of steam*, or any other locomotive power, than upon a level railway; that much would be gained by the power of gravity multiplied by active power down a descent; and that, consequently, a locomotive engine of any power would travel at a greater speed, or drag a greater weight, than upon a horizontal railway." Such, then, is the proposition of the author, and we do not doubt that our readers will join us in expressing surprise at an invention so widely differing from all preconceived notions. In our early youth we were taught that the shortest distance between two points was a straight line; and further, as a continuation of the same proposition, that the two sides of any triangle are greater than the third. Mr. Badnall will therefore attribute the ignorance we display, in not conforming to his views, to our early education, and not to prejudice of any other kind. But to return to the subject: in p. 52, the author gives an account of a first experiment, by which he attempts to prove the utility of his invention. "I had (he says) a curve made of the following proportions: from A to B was four feet, depth of curve 2 inches; *a* is a roller, so con-

structed as to move easily along the curve, and to revolve upon its axis, to each end of which was attached the string *s*, which passes over a pulley at the opposite end, and a weight was attached to the string to propel the roller. The curve, it should be stated, was formed on a solid piece of wood, so that by turning it over it would be a horizontal surface of 4 feet.

"The following experiments were made with different weights, just sufficient to move the roller along the surface when perfectly horizontal and at different inclinations.

Inclinations.	Over the horizontal plane	Over the curves.
On a perfect level	$2\frac{1}{2}$ sec.	$1\frac{1}{2}$ sec.
Rise of 3 in. in 48 in. . .	3	2
" 4 in 48 . . .	5	2
" 2 in 48 . . .	5	2
" 6 in 48 . . .	6	$2\frac{1}{8}$

"*Thus showing that the greater the angle of the incline the longer was the time required in passing along the plane;* whilst on the curve, the same exact weight being employed at each experiment, *the speed scarcely varied, and at all times was considerably greater than upon the horizontal plane.*" We have taken the liberty of putting parts of this quotation in italics, because we consider they answer the proposition of the author. We grant the results to be sufficiently correct for argument, though they cannot be mathematically true; and we should have been surprized had they been much otherwise. But let us take experiment by experiment: first asking why he tried inclined planes against inclined planes? because his proposition is undulating rai'ways in opposition to level or horizontal planes. In the first experiment, on a level 48 inches long, the roller was by a certain weight drawn from end to end in $2\frac{1}{2}$ seconds, whilst by the same weight the same roller on the curve was drawn 48 inches in $1\frac{1}{2}$ seconds, it will be evident that the roller in descending the first half of the curve would quickly get up its momentum, as would also the weight, whilst on the level plane the length of run would not more than admit the roller to arrive at its velocity; consequently this was by no means a fair trial. If the author had made a rail of 48 inches long, commencing with an inclination for the first 24 inches, the extent of rise being 2 inches, and then a descent of another 24 inches—this, if his proposition has any thing in it, would have been a more fair trial; the weight would cause the roller first to ascend 24 inches and descend the next 24 inches; and if, with such an arrangement, it had been discovered that the space of 48 inches was travelled in a less time than on a horizontal plane, we should be really inclined to look more seriously into the subject. Again, it will be seen in the second experiment, that of raising the level plane 3 inches at one end, which would produce an inclined plane of 3 inches in 48, whilst, on the other hand, in raising the curved surface 3 inches, the first half of the run would be very nearly on a level plane, and thus enable the roller to get up a momentum to meet the other half of the run, which would be an inclined plane of about 5 inches in 24; and such may be said of the other experiments of raising one end 4, 5, and 6 inches. It may be said of all the experiments described, that the length of the level plane is in no instance of sufficient length for the carriage or roller to get up its velocity till nearly to the end, whilst the carriage on the undulating road would get up its velocity by descending the first inclination. In making experiments either with a carriage or with boats, it is usual to commence marking time considerably after the same has started, so that it may be fairly considered to have got up its velocity; and had such a course been pursued in these experiments, very different results would undoubtedly have taken place. Thus, for instance, if the undulating road be 100 feet, and the horizontal plane be 100 feet, the speed or time ought not to be noticed till the carriage had travelled 40 or 50 feet; for the time of running of the carriage on the respective road should be only compared for the last 50 or 60 feet. In page 87, a quotation is given from Mr. Wood's admirable work on Railroads. The present author states that Mr. Wood (p. 202, second edition) calculates the resistance up a plane to be a given amount, say 56, and down the plane a given amount, say 22, and then draws his mean resistance or friction upon a level plane 39—thus, $\frac{56+22}{2} = 39$.

Mr. Badnall disputes this calculation of Mr. Wood, and states that the two powers of resistance added together and divided cannot show the mean resistance; he then says, "*I name this, because it particularly bears upon the principle on which I found my improvements; for if Mr. Wood be correct, it appears to me impossible that any advantage could accrue from the adoption of a curved or undulating line of road.*"

We finish our remarks with this last quotation, because it clearly expresses our opinion.—[Repertory of Arts.]

MECHANICS' SONG.

The following Song has been attributed to Dr. Franklin. It is said he wrote it for the Procession of Trades in Philadelphia, at the Adoption of the Constitution, on which occasion a press was drawn along the streets, and copies of it distributed to the multitude.

Ye merry *Mechanics*, come join in my song,
And let the brisk chorus go bounding along,
Though some may be poor, and some rich there may be,
Yet all are contented, and happy, and free.

Ye *Tailors!* of ancient and noble renown,
Who clothe all the people in country or town,
Remember that Adam, your father and head,
The lord of the world, was a tailor by trade.

Ye *Masons!* who work in stone, mortar and brick,
And lay the foundation deep, solid and thick,
Though hard be your labor, yet lasting your fame,
Both Egypt and China your wonders proclaim.

Ye *Smiths!* who forge tools for all trades here below,
You have nothing to fear while you smite and you blow,
All things you may conquer, so happy your lot,
If you're careful to strike *while your iron is hot.*

Ye *Shoemakers!* nobly from ages long past,
Have defended your rights with your *awl* to the *last;*
And *Cobblers*, all mercy, not only stop holes,
But work night and day for the good of our *soles.*

Ye *Cabinet Makers!* brave workers in wood,
As you work for the ladies your work must be good;
And *Joiners* and *Carpenters*, far off and near,
Stick close to your trades, and you've nothing to fear.

Ye *Hatters!* who oft with hands not very fair,
Fix hats on a block, for a blockhead to wear;
Though charity covers a sin now and then,
You cover the heads and the sins of all men.

Ye *Coach-makers* must not by *tax* be controlled,
But ship off your coaches, and fetch us home gold,
The roll of your coach made Copernicus reel,
And fancy the world to turn round like a wheel.

And *Carders* and *Spinners* and *Weavers* attend,
And take the advice of *Poor Richard* your friend;
Stick close to your looms, and your wheels, and your card,
And you never need fear of the times being hard.

Ye *Printers!* who give us our learning and news,
And impartially print for Turks, Christians and Jews,
Let your favorite toast ever bound in the streets,
The freedom of speech, and a volume in sheets!

Ye *Coopers!* who rattle with *driver* and *adze*,
And lecture each day upon hoops and on heads,
The famous old ballad of *Love in a Tub*,
You may sing to the tune of your rub a dub dub.

Ye *Ship-builders! Riggers!* and *Makers of Sails!*
Already the new constitution prevails!
And soon you shall see, o'er the proud swelling tide,
The ships of Columbia triumphantly ride.

Each *Tradesman* turn out with his tools in his hand,
To cherish the Arts and keep peace through the land;
Each *'Prentice* and *Journeyman* join in my song,
And let the brisk chorus go bounding along.

METEOROLOGICAL RECORD, KEPT IN THE CITY OF NEW-YORK,

From the 26th of August to the 21st day of September, 1833, *inclusive.*

[Prepared for the Mechanics' Magazine and Register of Inventions and Improvements.]

Date.	*Hours.*	*Thermometr.*	*Barometer.*	*Winds.*	*Strength of Wind.*	*Clouds from what direction.*	*Weather.*
August 26..	6 a. m.	66	30.03	WSW	light	WSW	fair
	10	74	30.04	SW by W	..	..	..
	2 p. m.	81	29.98	SW	.	..	..
	6	79	29.96	..	..	..	..
	10	74	29.90	..	..	..	..
" 27..	6 a. m.	69	29.82	..	..	..	..
	10	77	29.78	..	..	..	
	2 p. m.	85	29.70	..	moderate	WSW / WNW	
	6	78	29.73	..	..—gale	WSW	—gale at 8, from NW
	10 p. m.	74	29.78	SW—NW	fresh	..	..
" 28..	6 a. m.	63	29.83	..	..	WSW / NNW	..
	10	68	29.90	NNW	..	. . / : :	..
	2 p. m.	68	29.90	N	moderate	. . / : :	..
	6	66	29.90	..	..	. . / : :	..
	10	62	29.96	..	..	WSW	..
" 29..	6 a. m.	56	30.00	..	light	..	..
	10	62	29 99	WSW	..	.. / W	..
	2 p. m.	68	29.98	NW	fresh—mod.	W & NW	hail storm at 2, without thunder—fair
	6	60	30.03	N by W	moderate	W	fair
	10	54	30.10	..	..		clear
" 30..	6 a. m.	53	30.20	..	..	W	fair
	10	58	30.22	..	light	..	..
	2 p. m.	68	30.21	S	moderate	..	..
	6	64	30.18	..	..	..	..
	10	63	30.19	..	..	..	..
" 31..	6 a. m.	63	30.13	SW—WSW	..	W by S	cloudy —rain from 8 to 11
	10	65	30.12	WSW—SSW	..	..	rain —cloudy
	2 p. m.	70	30.06	SW	..	..	cloudy
	6	71	29.98	..	..	W—W by N	.. —clear —cloudy
	10	68	29.97	..	..	W by N	..

Arithmetical mean of the thermometer for the month of August, 71°.42.

Maximum height of the barometer in August, 30.22 in.—Minimum, 29.70 in.—Range, 0.52 in.

The observations of winds for August result as follows: From the North-Eastern quarter, including N. 28½—from the South-Eastern, including E. 30½—from the South-Western, 59—from the North-Western, 31.

The observations of the higher currents, as indicated by the clouds, result as follows: From the North-Eastern quarter, during 1½ periods of observation—South-Eastern, during 3½—South-Western, 83½—North-Western, 35½.

CITY OF NEW-YORK—CONTINUED.

Date.	*Hours.*	*Thermometr.*	*Barometer.*	*Winds.*	*Strength of Wind.*	*Clouds from what direction.*	*Weather.*
Septem. 1..	6 a. m.	68	29.87	WSW	moderate	W by N	fair—high haze from W by N
	10	76	29.88	W	..—fresh	..	.. — ..
	2 p. m.	81	29.89	NNW	fr'h—strong	.	..
	6	70	29.97	..	gale	..	.. —gale from NNW
	10	62	30.06	..	fresh	..	..
" 2..	6 a. m.	64	30.10	..	moderate		clear
	10	66	30.10	..	..	NNW	fair—light scattering scuds from NNW
	2 p. m.	70	30.09	..	light	..	..
	6	66	30.08	.	..	..	..
	10	63	30.11		..	W by N	cloudy
" 3..	6 a. m.	58	30.17	ENE—E	..	WNW	..
	10	66	30.19	SE—S	..	..—SW	..
	2 p. m.	72	30.15	S—WSW	..	WSW	..
	6	67	30.10	WSW	..	..	..
	10	66	30.08	S	moderate	..	..
" 4..	6 a. m.	67	30.00	SW	..	..	..
	10	75	29.99	..	light	.	fair
	2 p. m.	83	29.95	..	..	..	..
	6	78	29.90	.	..	WNW / SW	.. —high cirrus haze from WNW
	10	75	29.91	..	..	SW	..
" 5.	6 a. m.	74	29.92	..	moderate	WSW / SW	..
	10	80	29.95	WSW	..	WSW	..
	2 p. m.	84	29.97	W by S	..	W by S	.. [at Buffalo
	6	81	29.98	SW	..	..	.. —brilliant aurora borealis at 8½—gale
	10	76	30.04	WSW	light	..	..
" 6..	6 a. m.	69	30.16	W by S	..	WSW	..
	10	76	30.17	W	..	..	..
	2 p. m.	82	30.14	WSW	..	..	.. —cloudy
	6	76	30.11	..	..	..	cloudy [at Quebec
	10	72	30.10	..	..	..	.. —fair—aurora borealis at 10½—gale
" 7..	6 a. m.	67	30.17	WNW	..	WNW	fair [the sun
	10	74	30.20	NW—W by S	..	..	.. —brilliant parhelion circles about
	2 p. m.	76	30.16	WSW	mod.—fresh	W by S	cloudy
	6	74	30.12	..	moderate	..	.. —rain
	10	70	30.13		..		rain
" 8..	6 a. m.	60	30.01	NE by E	..—fresh	ENE	..
	10	62	30.00	NE	fresh—mod.		.. —rainy
	2 p. m.	63	30.03	..	moderate	NE	cloudy—scuds from NE
	6	62	30.08	NNE	..	NE by N	.. —fair
	10	59	30.18		..		fair
" 9..	6 a. m.	60	30.19	NNE	..	ENE	cloudy
	10	64	30.17	..	..	..	fair —cloudy
	2 p. m.	67	30.17	SE	..	ESE / NW	cloudy —fair —cloudy
	6	65	30.14	..	..	ESE	fair
	10	63	30.10	..	light	..	cloudy
" 10..	6 a. m.	65	29.98	SSW	..	SW	.
	10	70	29.92	SW	..	..	.. —fair —cloudy
	2 p. m.	73	29.87	..	..	WSW	fair
	6	72	29.83	..	..	..	..
	10	68	29.90	..	..	.	..
" 11..	6 a. m.	60	30.01	NNW	..	..	..
	10	65	30.02	..	moderate	.. / NW	..
	2 p. m.	70	30.01	NW	..	WNW	..
	6	67	30.04	..	..	W	..
	10	62	30.10		..		..
" 12..	6 a. m.	59	30.17	NNE		W by S	cloudy
	10	65	30.20	..—W by N	light	WSW	.. —rain
	2 p. m.	57	30.18	N by W to W	..	.. / NNW	rainy —fair at W
	6	55	30.19	..	..	WSW	fair
	10	54	30.22		..		clear
" 13..	6 a. m.	50	30.28	N by W		WSW—NNW	.. —fair
	10	56	30.31	..—NNW	moderate	N by W	fair
	2 p. m.	59	30.30	NNW	..		..
	6	58	30.27	..	..		..
	10	54	29.27		..		clear
" 14..	6 a. m.	49	30.24	NNW—WSW			..
	10	58	30.25	WSW—W by S	light		..
	2 p. m.	65	30.06	W by S	moderate		..
	6	62	30.08	WSW	..		..
	10	59	30.07		..		..
" 15..	6 a. m.	56	30.08	W by S	light	W by S	fair

CITY OF NEW-YORK—CONTINUED.

Date.	*Hours.*	*Thermometr.*	*Barometer*	*Winds.*	*Strength of Wind.*	*Clouds from what direction.*	*Weather.*
Sept'r 15..	10 a. m.	63	30.10	NW—WSW	light	W by S	fair
	2 p. m.	63	30.05	SW—S	..	..	..
	6	65	30.02	S—WSW	..	..	.. —haze clouds
	10	62	30.03		..	..	..
" 16..	6 a. m.	56	30.11	NNW	moderate	NNE	.. —light scuds from NNE
	10	63	30.18	NNE		..	..
	2 p. m.	67	30.17	..	light	..	..
	6	65	30.18	..	..	..	..
	10	63			..	..	..
" 17..	6 a. m.	56	30.25	NNE—W by S	faint	W by S / SW	..
	10	63	30.28	SW—S	light	..	..
	2 p. m.	70	30.22	S	mod.-fresh	.. / SW	.. —cloudy
	6	65	30.21	..	fresh	..	cloudy
	10	62	30.20	..	..	..	..
" 18..	6 a. m.	62	30.10	..	..	SW	.. —rainy
	10	64	30.07	SSW	..	..	rain
	2 p. m.	66	30.00	SW	moderate	..	..
	6	67	30.00	..	..	..	cloudy
	10	67	30.00		calm		..
" 19..	6 a. m.	67	30.00	SW	light	WSW	.. and foggy —fair
	10	70	30.02	..	..	..	fair
	2 p. m.	80	30.00		..	..	
	6	76	29.97	WSW	..	..	.
	10	74	29.98			..	.
" 20..	6 a. m	76	29.97		moderate	..	..
	10	80	29.94	SW	.	..	..
	2 p. m.	84	29.91		.	..	
	6	81	29.90				—clouds and lightning at W & N
	10	76	29.89				cloudy —thunder shower
" 21..	6 a. m.	69	29.92	NNW—N		SW / N	.
	10	66	30.00	N	..	SW	..
	2 p. m.	66	30.00	N by W	..	..	..
	6	65	30.03	..	..		
	10	61	30.10	..	..	.	..

METEOROLOGICAL RECORD, KEPT AT AVOYLLE FERRY, RED RIVER, LOU.

For the month of July, 1833—(*Latitude* 31.10 *N.. Longitude* 91.59 *W. nearly.*)

Date. 1833.	*Thermometer* Morn'g.	Noon.	Night.	*Wind.*	*Weather Remarks &c.*
July 1	73	89	83	calm	clear—light flying clouds—Red River falling
" 2	73	89	82	..	.. —evening wind W—ocre grown for use, and cayenne pepper ripe
" 3	72	80	80	N—high	.. all day—pulled fodder
" 4	68	84	78	N—light	.. .
" 5	67	86	78	calm	.. . —planted pole and bunch beans
" 6	72	88	83	SE	.. . —bent down corn
" 7	76	89	80	calm	.. —evening cloudy—heavy thunder and light shower
" 8	72	90	83	SW—light	.. — .. .
" 9	79	91	80	W	.. — .. gale from W—heavy thunder and light shower
" 10	74	90	83	..	.. all day—planted corn-field peas
" 11	73	90	83	W—light	..
" 12	74	90	79	calm	.. —evening wind S—at 5 p. m. thunder shower
" 13	73	88	77	..	. — .. —at 4 p. m. .. ..
" 14	74	89	79	..	.. — .. .. N—at 6 p. m. .. ..
" 15	74	87	77	NE	cloudy all day
" 16	73	87	79	..	clear—flying clouds
" 17	70	84	81	..	.. — .. .. —evening calm.
" 18	71	90	82	calm	..
" 19	74	91	82	SE—light	..
" 20	73	90	80	calm	.. —night cloudy and thunder, no rain
" 21	75	90	78	..	. —at 5 p. m. heavy thunder shower from S
" 22	74	88	82	NE—light	..
" 23	74	91	82	calm	.. —evening wind SE, light
" 24	75	91	82	..	.. — .. .. S, ..
" 25	72	89	82	..	..
" 26	73	90	83	S—light	..
" 27	73	91	84	calm	..
" 28	73	92	86	..	..
" 29	76	93	77	W	.. —evening heavy thunder shower
" 30	74	86	81	..	.. —flying clouds
" 31	76	84	76	..	cloudy—showers

Red River has fell this month 4 feet 10 inches, and is now 5 feet 8 inches below high water mark of 1828.